OCTOBER 1960

Utility engineering section begins on page 59

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See page 38

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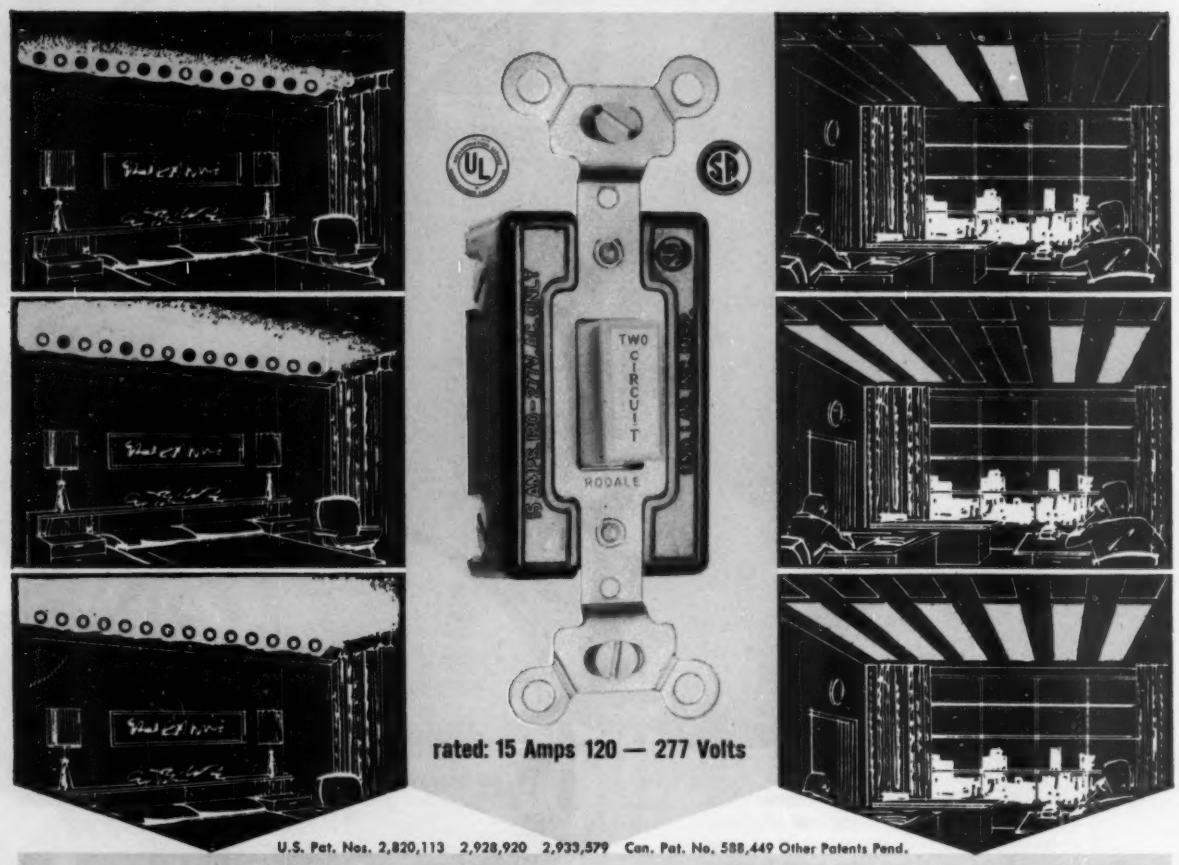

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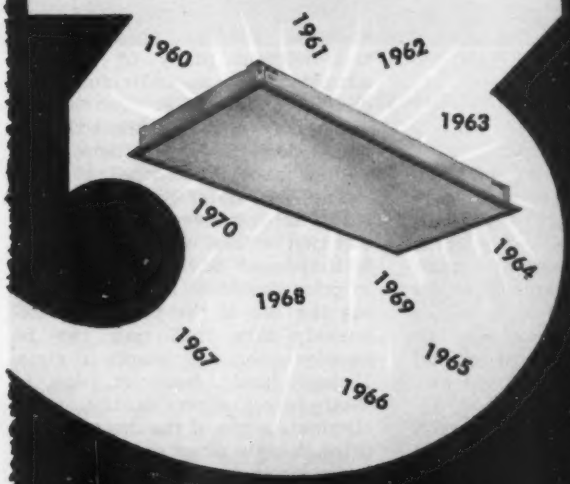

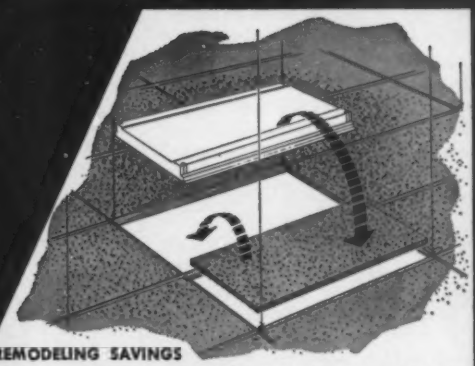

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

Industry and consumers exercise careful buying

As the fourth and final quarter of 1960 gets under way, careful buying seems to shade the economic picture. In past quarters, this trend was evident among business buyers, many of whom were working diligently to pare down excess inventories. Now that these inventories are down to a relatively workable size, there seems to be resistance to more than hand-to-mouth buying.

Perhaps this situation can be traced to a relative uneasiness since business has held to its present plateau for the past few months. On the other hand, it is highly possible that businessmen feel that their inventory position is now more manageable than in the past. Unless a heavy spurt should appear in the market, they might be inclined to continue operating with skeleton inventories.

During the last month, there has been growing caution among consumer buyers as well. Starting slowly at first, this condition has now become a rather well-defined trend and may have an impact on the achievement of economic records both in 1960 and in 1961. The years 1958 and 1959 were supported heavily by the confidence of consumers as found in the market place.

Even when business activity tended to slip slightly, the consumers through their purchases put sufficient pressure on the economic scene to force economic activity back to prosperous conditions. If this force is to fail, or does not regain some strength in the closing months of this year, then the story on economics of 1961 may be entirely different from that of recent years.

The sale of consumer durables continues to lag and this is now the weak spot on the economic horizon. Slack demand is reflected all the way from kitchen appliances to automobiles, and it does not appear that this condition will be corrected quickly. The new model changes in the automotive field may spur sales of passenger cars in the next few months, although the heaviest demand should not occur until early in 1961.

Recognition of the doldrums in the appliance field by the manufacturers may result in some new high-powered merchandising techniques that will convince the consumers that they should re-enter this field. But it will take some unusual circumstances to snap consumers out of this apathy and get them in a buying mood once more. It would appear that the often-cited question of national election results might have a bearing upon present conditions, but the effect upon consumer actions is doubtful.

The possibility of a reversal of present conditions may be solidly connected with (1) a change in business buying policies allowing a buildup of inventories in anticipation of greater consumer buying strength, and (2) some very forceful new selling techniques devised to attract consumers back into the market place now.

Common stocks or mutual funds

The current depressed condition of the stock market has once again brought forth a flurry of anxious comments relative to the wisdom of using common stocks as a basic investment mechanism. It seems that many persons buy such issues with the theoretical belief that the prices will continue to go up and will not decline, at least to any great extent.

This reasoning, to the person with even average knowledge of investments, is extremely fallacious and possibly indicates that the person raising the questions should never have entered the stock market scene. Noted financial writers have warned stock buyers over and over again that there is no guarantee that stock prices will rise, or, if on the way up, will continue to rise.

The very nature of the stock market mechanism where buyers and sellers join together in the exchange of securities will force an upward or downward movement of prices dependent upon conditions existing at the time. The answer, of course, is for the investor to plan his investment program around specified goals and objectives such as growth, income, and the like. Then, with competent investment advice, buy only those securities of sound enterprises that tend to promote the achievement of these objectives.

Whenever fluctuations in market prices of common stocks appear, particularly if in the downward direction, the question of acquisition of mutual funds versus common stocks is often raised. The value of good mutual funds as a sound investment technique, especially for the layman, has often been commented upon in this column.

The investor of modest means and without a sound knowledge of the merits of individual corporate issues can avail himself of an investment program of diversification without many of the disadvantages of an individual purchase approach. Yet even in this case, there is the inherent danger of adverse price fluctuations as well as favorable changes.

The best statement that can be made for any investment program, common stocks or mutual funds, is that some adverse fluctuations in price should be anticipated during the life of the plan. It is extremely rare that such can be avoided over any length of time. Mutual funds, however, due to their broad diversification, may eliminate some of the more drastic price changes often encountered in investing in one or a few issues.

Although the careful investment in so-called "blue chip" securities also tends to avoid widespread price fluctuations, even these can move in direct relationship to the general market trend. Thus, if the general market picture is one of

(Continued on page 143)

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

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WOODSIDE 77, NEW YORK

Washington report

By Jack James

Digest of Washington news of special interest to the electrical industry

Secondary boycott bill will rebound

THOUGH Congress failed to pass a bill to permit secondary boycotts at construction sites, congressmen plan to take up this issue when they return to Washington in January.

The common site picketing bill got as far as Senate Labor Committee and the House Rules Committee in the last Congress.

If the Democrats control the House next session, this means that Rep. Adam Clayton Powell (D-N.Y.) will head the House Labor Committee. [Rep. Barden (D-N.C.) former chairman of the Committee retired.]

Powell promises a thorough airing of alleged racial discrimination in the AFL-CIO building trades unions when hearings are held on the common site picketing bill. He said that the need for an anti-discrimination clause "should be brought out and explored for the good of the labor movement."

Such clauses were proposed in both House and Senate Labor Committees in the last session and rejected. In effect, these clauses would forbid secondary boycotts at construction sites by unions that practice racial discrimination.

On two other major issues, minimum wage and aid-to-education, the House Labor Committee will have an important voice. Powell plans to get bills on both issues out of committee by Feb. 1, 1961.

Fringe benefits grow to sizeable amounts

FRINGE benefits help your employees in emergencies when wages stop because of sickness, unemployment, and retirement. They are valuable. They cost a lot too.

Some 1,060 big and little business firms throughout the country paid $1,132 for fringe benefits in 1959 on an average for each employee, according to a report by the Chamber of Commerce of the United States.

Fringe benefits paid by 108 firms which participated in previous Chamber surveys doubled between 1947 and 1959.

Employees averaged $22.80 in fringe benefits for every $100 in wages, the Chamber reported in its 36-page pamphlet *Fringe Benefits 1959*. The breakdown on that $22.80 is: Social Security, unemployment compensation, workmen's compensation, and other legally required benefits, $4.20; private pension and insurance programs, separation pay, and other agree-upon payments, $7.20; paid vacations, holidays, rest periods, sick leaves, and other payments for time not worked, $9.60; profit sharing payments, bonuses, and similar payments, $1.80.

Small business agency sets up local offices

SMALL businesses which need loans but cannot get them from the banks can turn to the Small Business Administration.

This is a federal agency with offices throughout the nation. Twenty are in the South. It will loan up to $350,000 to a small business, if the loan is sound, and if it cannot be obtained from a bank. Interest rate is 5½ per cent.

Contractors with an average of less than $5 million gross a year for the past three years qualify as small business men.

The Small Business Administration says that in most cases it will decide within three weeks after an application has been filled in whether to make the loan.

The 20 Southern offices are at: Atlanta, Ga.; Baltimore, Md.; Birmingham, Ala.; Charleston, W. Va.; Charlotte, N. C.; Columbia, S. C.; Dallas, Texas; Houston, Texas; Jackson, Miss.; Knoxville, Tenn.; Little Rock, Ark.; Louisville, Ky.; Lubbock, Texas; Miami, Fla.; Nashville, Tenn.; New Orleans, La.; Oklahoma City, Okla.; Richmond, Va.; San Antonio, Texas; and Washington, D. C.

For addresses and telephone numbers of these offices, check the telephone books.

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Government takes steps to spur the economy

DESPITE its economists' views, the government has quietly been taking steps to spur the economy:

—The Federal Reserve Board has been reducing the rediscount rate and expanding lending power of banks to make loans to business men both cheaper and easier to get.

—The Administration doubled its rate of spending on the vast federal highway construction program; accelerated defense spending.

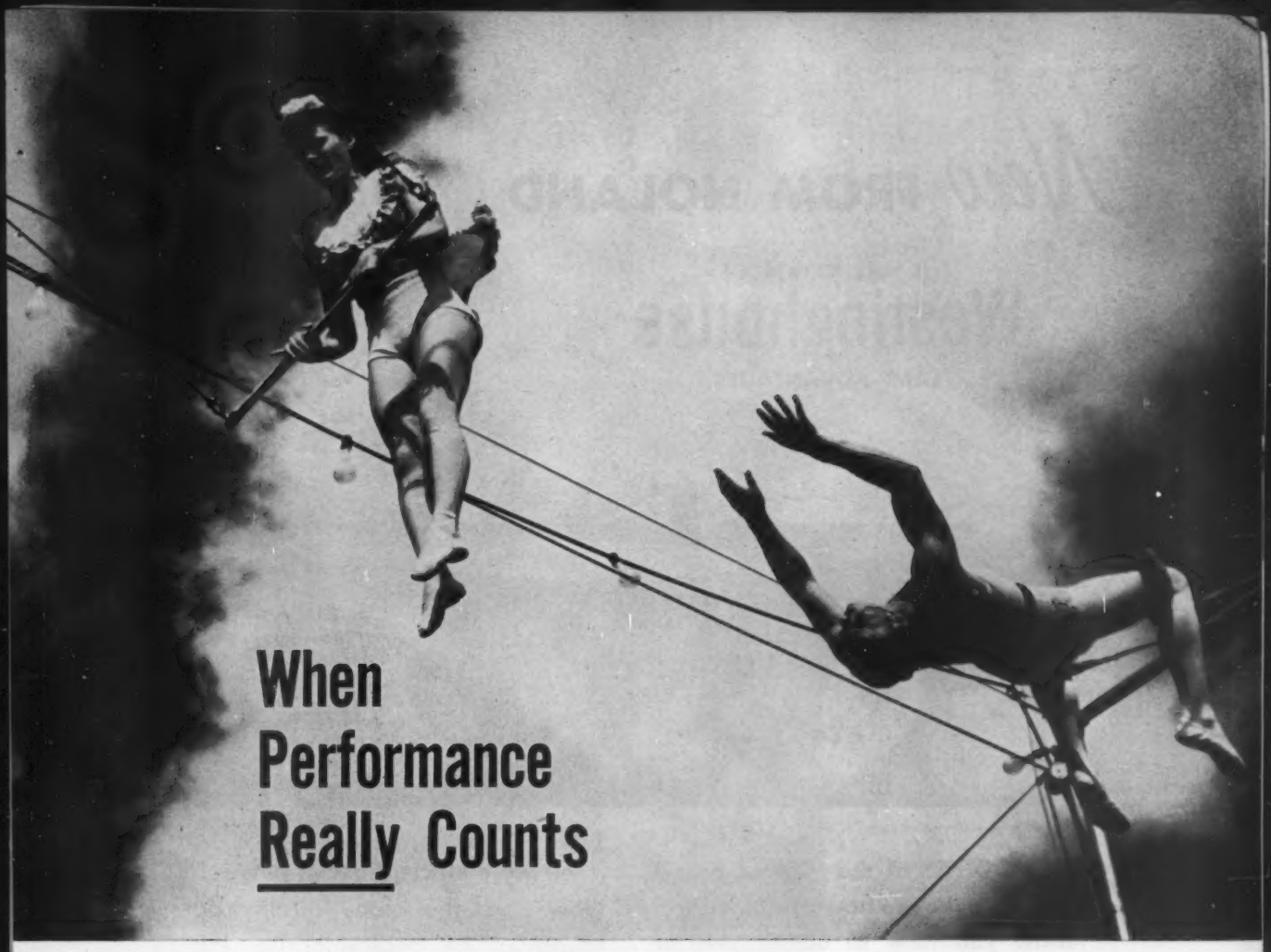
—To aid the home building industry, the Federal Housing Administration liberalized mortgages on low-cost homes; the Federal National Mortgage Agency lowered its discount rate on FHA mortgages to make their purchase more attractive to bankers.

Experts differ on economic outlook

THE PRESIDENT'S Council of Economic Advisers expects that the economy will at least remain on the high plateau that it has reached if it does not keep up its two per cent growth rate.

Value of new construction in

(Continued on page 148)



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Class A (Double Galv.) High Strength	29600	18800	14500	10800	8000	6400	4750	2850
Class A (Double Galv.) Extra High-Strength		26900	20800	15400	11200	8950	6650	3990
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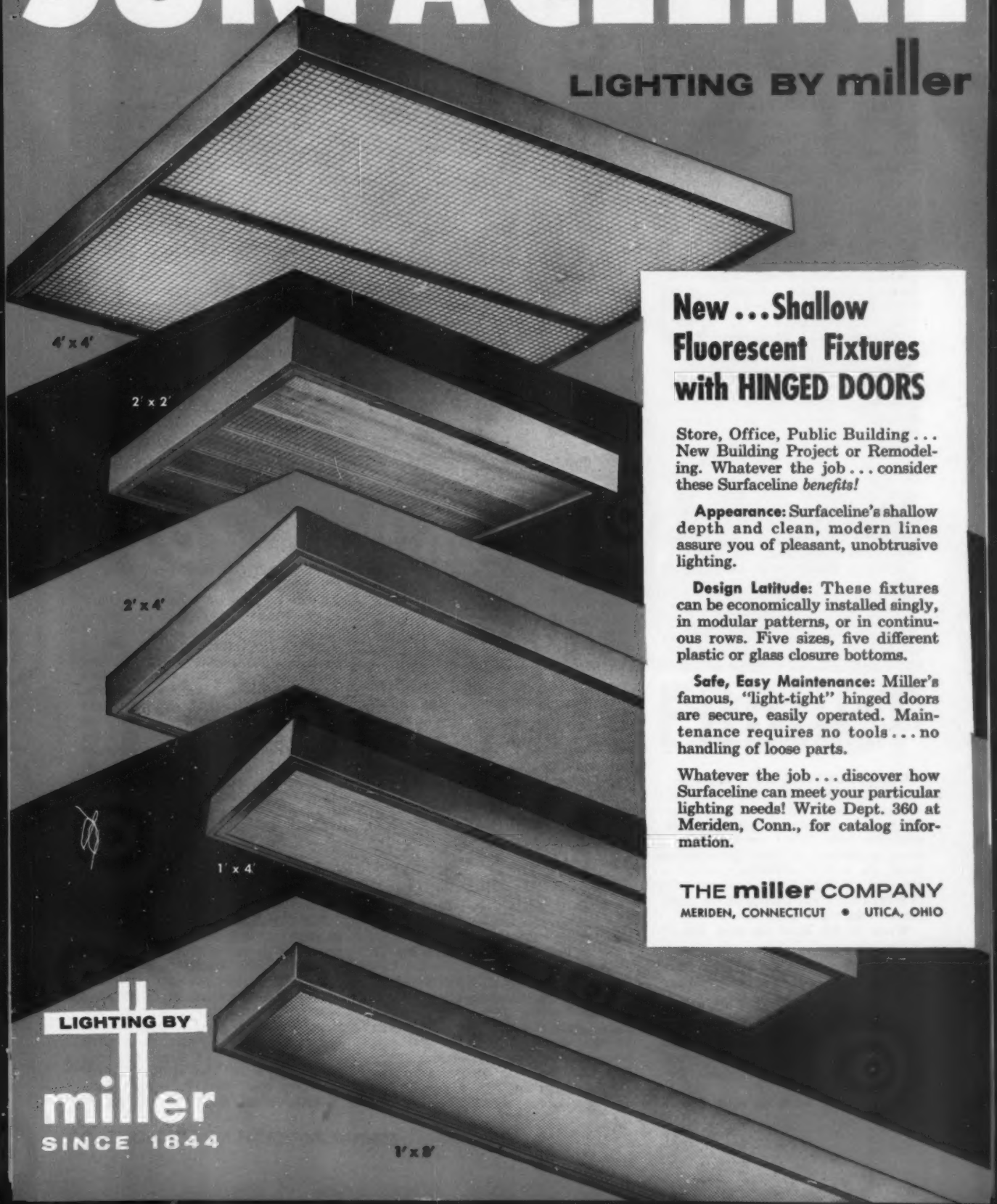

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ELECTRICAL BOXES—Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa., offers a catalog of their complete line.

Write in No. A102 on card, Pg. 17

STEEL WIRE—Technical information on Alumoweld, a newly developed aluminum-covered steel wire and strand, is contained in a 12-page catalog, just issued by the Wire and Cable Division of Copperweld Steel Co., 322 Frick Building, Pittsburgh 19, Pa. Illustrated and documented with engineering data, the colorful catalog provides a complete working knowledge of this new material—its properties, advantages, applications and construction practices.

Write in No. A103 on card, Pg. 17

ELECTRICAL FITTINGS — A 40-page illustrated catalog and price list on the Gedney line. Shown and listed are conduit, threaded entrance, SEC, EMT and ground fittings and box connectors for both armored and non-metallic cables. Copies are available from Gedney Electric Co., RKO Bldg., Radio City, New York 20, N. Y.

Write in No. A104 on card, Pg. 17

CONSTRUCTION ANCHORS—"Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

Write in No. A105 on card, Pg. 17

SERVICE PANELS — Information on protective electric control centers for homes, apartment buildings, service stations, and industrial applications is contained in Bulletin PM-385, "BullDog Pushmatic Electric-Centers," issued by BullDog Electric Products Co., 7610 Jos Campau, Detroit, Mich.

Write in No. A106 on card, Pg. 17

ELECTRICAL FITTINGS — Blackhawk Industries, Dubuque, Iowa, offers a complete catalog of electrical conduit and cable fittings. Also a special publication giving detail drawings and instructions for installing service entrance masts on low or ranch type buildings.

Write in No. A107 on card, Pg. 17

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

Write in No. A108 on card, Pg. 17

GENERAL CATALOG — General catalog of Royal Electric Corporation, Pawtucket, R. I. covering flexible, service and lamp cords, cord sets, extensions, trouble lights, wiring devices and fuses is available to wholesalers. Dealers catalogs may be secured from Royal distributors.

Write in No. A109 on card, Pg. 17

CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

Write in No. A110 on card, Pg. 17

POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A111 on card, Pg. 17

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A113 on card, Pg. 17

COMPRESSION CONNECTORS — New and fully illustrated Bulletin 13 offered by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A114 on card, Pg. 17

SELECTING FUSES — A 12-page descriptive handbook "Fuseology tells how to get safest most dependable, trouble-free electrical protection from fuses. Contains useful information on selecting right size and type of fuses —how to stop needless blows—avoiding poor contact and other troubles. Issued by Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

Write in No. A115 on card, Pg. 17

LIGHTING FIXTURE DATA—The Perfeclite Co., 1457 East 40th Street, Cleveland 3, Ohio, makes available the following literature: (1) Data Folder 54-B—4 pages of engineering information, prices and specifications on Plastic Indirect Concentric Ring Luminaires. (2 Data Folder EX-57—10 pages of information on Exit Units for all building locations. Complete Engineering data and prices given. (3) Data Folder 56-A—Information on Ceiling Pan Fixtures and Vapor Proof Prismatic Exterior Fixtures. (4) Data Folder 58-A on Concrete Mounting Boxes for recessed incandescent units. (5) Data Folder 58-B on Fluorescent Exit Units. (6) Data Folder 58-C on Phosphorescent Exit Units. (7) Data Folder 57-A on extra shallow recessed units and square ceiling pans. (8) Catalog 956—60 pages plus 12-page supplement, complete with descriptions and engineering information. (9 Data Sheet 57-D—a two-page description of square ceiling pan units and exterior conduit mounted-pan-type units.

Write in No. A117 on card, Pg. 17

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A120 on card, Pg. 17

Completed 1960
FIRST NATIONAL—
NORTH AVENUE BUILDING
Architect
Francis P. Smith & Henry S. Smith
General Contractor
Daniel Construction Company
Electrical Engineer
Newcomb & Boyd
Electrical Contractor
J. M. Clayton Company
Electrical Wholesaler
Westinghouse Electric Supply Co.

Under Construction
1375 PEACHTREE BUILDING
Architect William H. Hardeman
General Contractor
The Massell Companies
Electrical Engineer
Thomas Earle Blakely Assoc.
Electrical Contractor
Whitehead Electric Company
Electrical Wholesaler
Westinghouse Electric Supply Co.

Under Construction
THE ELECTRIC BUILDING
Architect
Finch-Alexander-Barnes-Rothschild & Paschal
General Contractor
Henry C. Beck Company
Electrical Engineer
Thomas Earle Blakely Assoc.
Electrical Contractor
Bagby Elevator & Electric Company
Electrical Wholesaler
Electrical Wholesalers, Inc.

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is the word for advanced underfloor systems in dynamic new buildings

On booming Atlanta's Peachtree Street . . . one of the high spots of southern building activity . . . no less than *seven* important new structures are Walkerduct-equipped.

Why was Walkerduct the unanimous choice?

Because of these unique features, so advantageous to occupants and operators alike:

Capacity Large No. 4 duct can be used in various combinations with No. 2 duct.
Convenience 2" IPS inserts with belled-out base provide easier, quicker, safer wire-pulling.
Versatility Rings and tops on junction boxes are adjustable upward for final leveling even **after** concrete sets.
Range Broad line of junction boxes and Walkerduct systems meets needs of all varieties of floor construction.
Foresight Walkerduct allows future electrical expansion at minimum cost.

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Conshohocken, Pa.
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Wire & Cable—Rigid Steel Conduit & EMT

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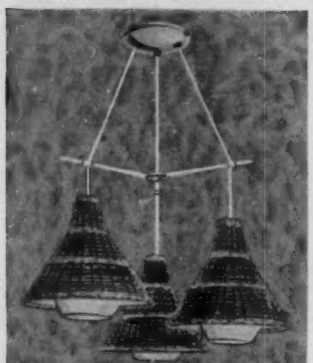
SUN 'N SAND Unique, different . . . appealing! Shades are an arresting blend of imported Italian sand-tone reed, handwoven with glistening brass accents. Satin white, diffusers. Sun 'N Sand — original . . . beautiful . . . modern!

V-5675 For hallways or tasteful accent lighting. Length 8¼", diameter 6½". One 100-W.



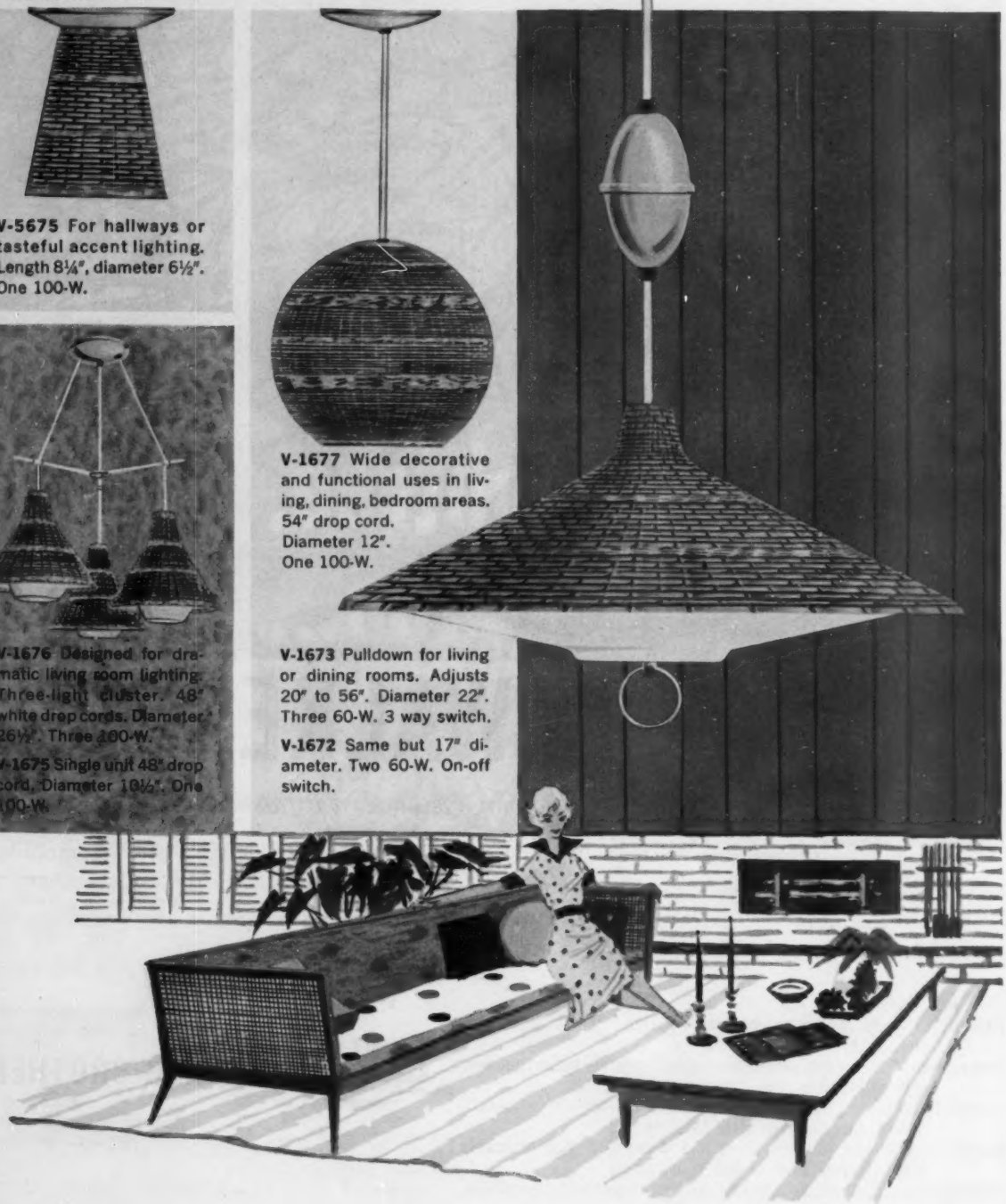
V-1676 Designed for dramatic living room lighting. Three-light cluster. 48" white drop cords. Diameter 26½". Three 100-W.

V-1675 Single unit 48" drop cord. Diameter 10½". One 100-W.

V-1677 Wide decorative and functional uses in living, dining, bedroom areas. 54" drop cord. Diameter 12". One 100-W.

V-1673 Pulldown for living or dining rooms. Adjusts 20" to 56". Diameter 22". Three 60-W. 3 way switch.

V-1672 Same but 17" diameter. Two 60-W. On-off switch.

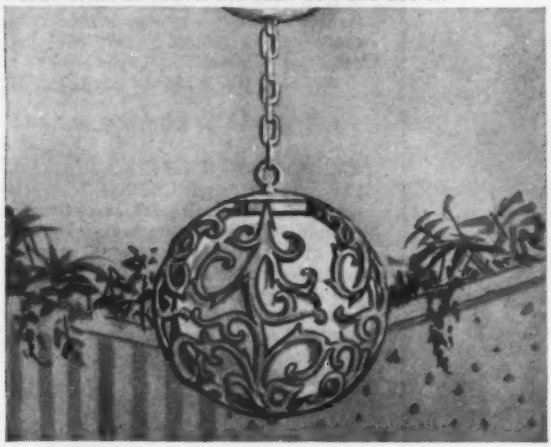


new custom creations

FLORENTINE SERIES Exquisitely detailed scrolls cast in aluminum. Antique white color delicately toned with gold fleck. White opal globes. Matching white chain. Here is new richness for all homes — contemporary, transitional, traditional!

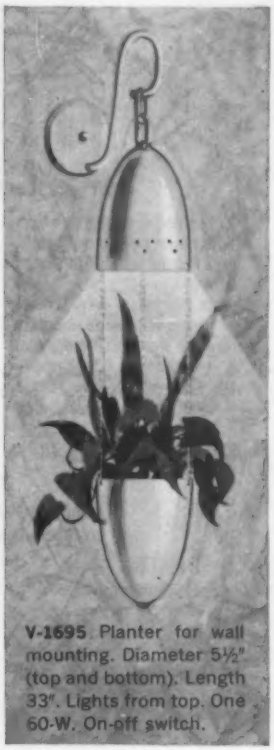
V-1713 Perfect in foyers, living rooms, dining areas. Spread 31" (6' chains and yolk). Three 100-W.

V-1712 Diameter 12". Matching white 6' drop chain. One 150-W.
V-1710 Same as above: Diameter 10". One 100-W.



PLANTER SERIES Bright ideas! Lighting fixtures that double as planters. Perfect accents for fireplace, entranceways, in dinettes or family rooms . . . wherever you want a touch of eye-catching beauty!

V-1690 Polished brass. Diameter 15⅜". Length 36". Lights from top. Three 60-W. 3 way switch.



V-1695 Planter for wall mounting. Diameter 5½" (top and bottom). Length 33". Lights from top. One 60-W. On-off switch.

These are just a few of the fresh, new custom creations available...fixtures so delightfully different and irresistibly styled..."to show is to sell." Free colored brochure describing the full line available. See your nearest Virden Lighting distributor or write direct using the coupon below.

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MEMBER AMERICAN HOME LIGHTING INSTITUTE

VIRDEN LIGHTING DEPT. ES-10
DIVISION OF JOHN C. VIRDEN COMPANY
5209 EUCLID AVENUE
CLEVELAND 3, OHIO

Name_____

Address_____

City_____ Zone____ State____

SUBSIDIARIES: LIGHTING DYNAMICS, INC., LOS ANGELES, CALIF. AND DALLAS, TEXAS; JOHN C. VIRDEN, LTD., TORONTO, ONTARIO.

SPARKY SAYS:

THE WIEGMANN LINES ARE MY CHOICE!

Approved and preferred by electricians, contractors and architects everywhere.

SWITCH AND OUTLET BOXES:

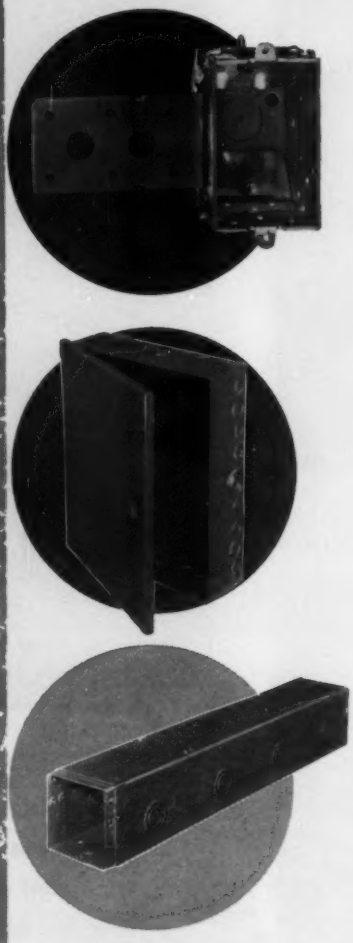
Over 250 stock items from the simplest nail-up switch box, to nine gang boxes. All popular sizes of knockouts and types of clamps. Brackets are **riveted** (not spot welded) to boxes for maximum strength. Combination box and bar sets that save time and money for the contractor. All packaged in sturdy cartons with attractive, descriptive, easily read labels.

CUTOUT AND PULL BOXES:

Over 100 stock sizes for immediate shipment. Hinge cover cabinets and surface and flush pull boxes in baked gray enamel or galvanized finish. Also transformer cabinets, telephone cabinets, rain tight and weather proof cabinets. Custom enclosures made for every electrical requirement.

100% LAY-IN SERVICE DUCT AND FITTINGS:

New improved designs save contractors as much as 25% installing time. Hinge Cover and Screw Cover types — with or without knockouts, in baked gray enamel or galvanized finish. Key hole slots in screw covers, oblong holes for quick attachment of connectors, combination spring swivel, positive active latches on hinge cover duct, all fittings including crosses, tees, elbows, panel adaptors and hangers.



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(located in metropolitan St. Louis means fast delivery everywhere)

CABLE CONNECTORS — Tomic Sales and Engineering Co., 20000 Sherwood Ave., Detroit 34, Mich., now have available catalog sheets containing data on the complete line of their connectors, couplings, and cable connectors.

Write in No. A121 on card, Pg. 17

WIRING DEVICES — A complete new catalog of wiring devices is now available from Bell Electric Co., 5735 S. Claremont Ave., Chicago 36, Ill. The line includes a wide range of weatherproof receptacles and switches, portable garden light, wall plates, and specialty items.

Write in No. A122 on card, Pg. 17

PLUG-IN REELITE — Complete details about Appleton's lightweight, portable automatic Reelites are given in an attractive 4-page catalog insert. These devices find application in a wide range of occupancies: garages, loading docks, garment industry, construction crews, warehouses, machine shops, etc. Write to Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

Write in No. A124 on card, Pg. 17

WIRING PRODUCTS — Various features of J&S Despard interchangeable wiring devices and detailed information concerning this line are offered in a brochure released by Pass & Seymour, Inc., Dept. ES, Syracuse 9, N. Y. Included are such features as Camstrap for quick, easy installation, three-wire grounding, and pressure terminal devices.

Write in No. A125 on card, Pg. 17

FLUORESCENT BALLASTS—Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill., has recently completed the compilation and printing of a 20-page catalog on fluorescent ballasts and their use. Included are data sheets on available advance ballasts and a comprehensive installation and operation section and testing procedures. Copies of the booklet are available on request.

Write in No. A126 on card, Pg. 17

GUTH INDUSTRIAL LIGHTING BROCHURE — New 8 page, 4 color brochure by The Edwin F. Guth Company, 2615 Washington Blvd., St., Louis 3, Missouri, describes Guth KOLORKODED industrial lighting fixtures. This unique innovation of color coding luminaires opens a new field in industrial lighting. Folder includes photographs, lighting data, engineering information and complete descriptive data on KOLORKODED

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Instead of writing a dozen different manufacturers for free literature and more information on products, tools, or services, just insert on the cards below the appropriate key numbers of the items in which you are interested. These cards may be used to get information on products mentioned in the following departments (see Contents Page for page number):

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ATLANTA 8, GEORGIA

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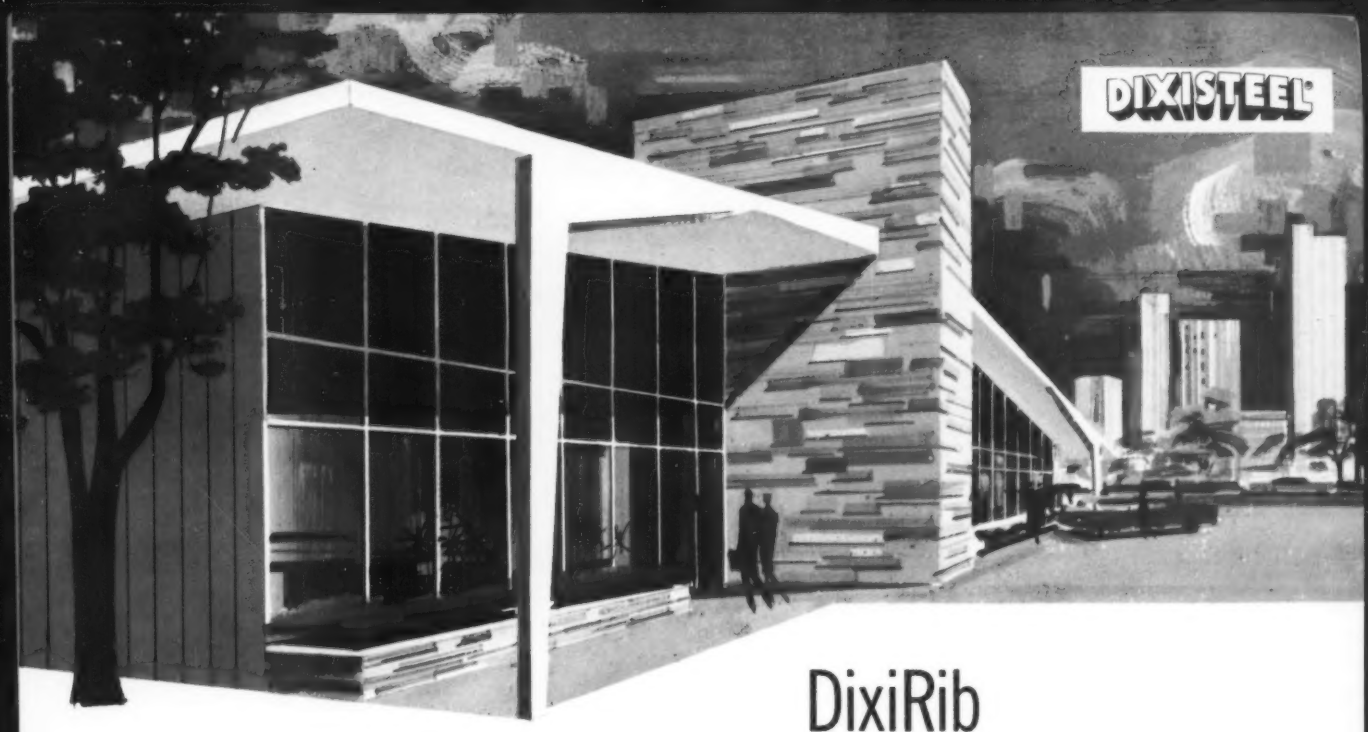
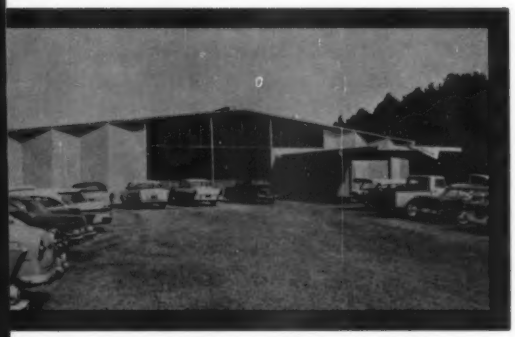
City _____ Zone____ State____



DixiRib

PERMA-COLOR PANELS

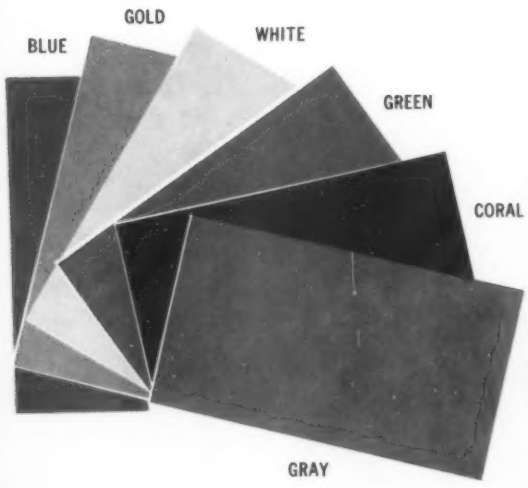
add New Beauty and Versatility to DIXISTEEL BUILDINGS



Your DIXISTEEL Building can be as bright and beautiful as you want it. Six modern, compatible colors offer unlimited opportunities in style and appearance. And the distinctive design of DIXIRIB Panels takes full advantage of light reflection and shadows to further enhance the beauty of DIXISTEEL Buildings.

DIXIRIB Perma-Color Panels are roll-formed from 26-gauge galvanized coiled sheet. They are 100% plumb and true every time, fit together easily and perfectly. The two-coat, baked-on vinyl enamel finish will last for years—resists corrosion, weather, rust, and abrasion.

DIXISTEEL Buildings offer you a low-cost, quick way to have a modern, colorful building for any purpose. Get the facts from your nearest DIXISTEEL Building dealer, or . . .



TEAR OFF AND MAIL THIS COUPON FOR FULL INFORMATION

☐ *Yes!*

Please send me data and information on DIXISTEEL Buildings

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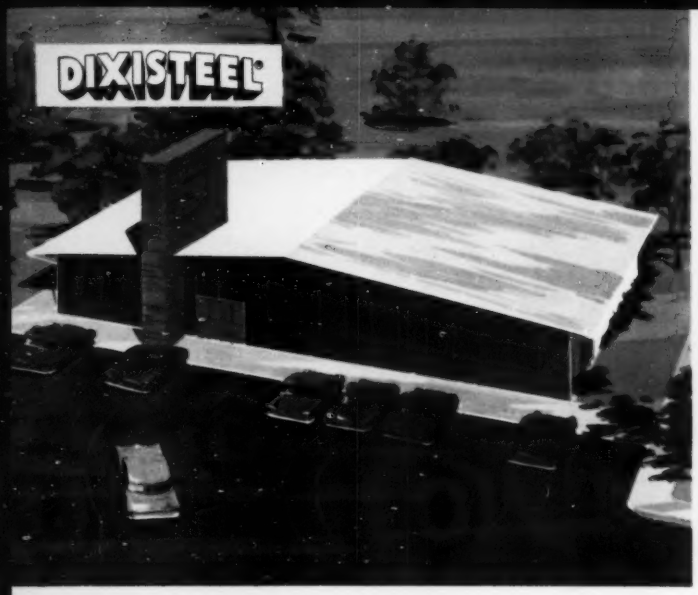
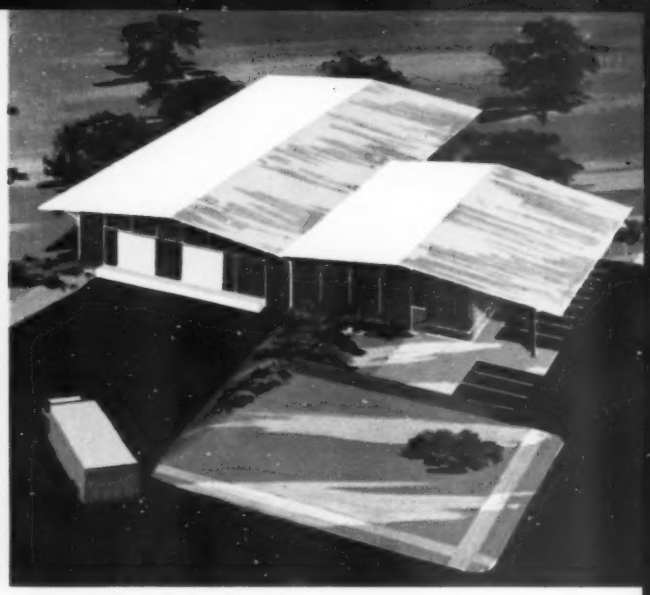
COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____





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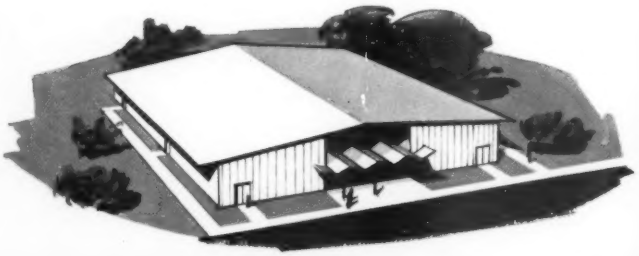

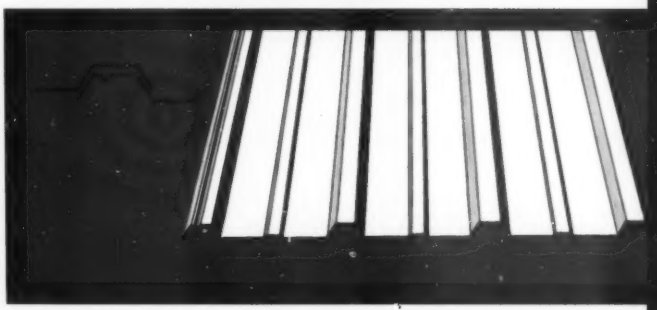

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PHONE: AD 7-2091

Birmingham
Atlantic Steel Co.
Steel Bldg. Division
P. O. Box 3067
Avondale Sta.
4230 - 1st Ave., South
PHONE: WO 1-2147

Dothan
Hollis & Spann, Contractors
202 S. Alice St.
PHONE: SY 2-1391

Huntsville
Putman Const. Co.
120 Leeman Ferry Rd., S. W.
PHONE: JE 6-6337

Montgomery
American All-Steel Bldgs. Co., Inc.
P. O. Box 3182
1701 Owens St.
PHONE: AM 4-3207

Piedmont
Ellis-Allen Tractor Co.
104 N. Main St.
PHONE: GI 7-4561

Tuscaloosa
Charles Temerson & Sons
P. O. Box 378
2104 -4th St.
PHONE: PL 2-1506

FLORIDA

Gainesville
H. A. Lee Steel Co.
1800 N. E. 23rd Blvd.
P. O. Box 605
PHONE: FR 6-7741

Jacksonville
Atlantic Steel Co.
P. O. Box 2614
1641 Landon Ave.
PHONE: EX 8-5231

Largo
Bailey Builders, Inc.
420 Indian Rocks Road
PHONE: JA 4-1454

Ormond Beach
Tom Daugherty Steel Bldgs.
666 Buena Vista Ave.
PHONE: OR 7-1868

Riviera Beach
Wambaugh Steel Bldgs.
333 Linda Lane
P. O. Box 86
PHONE: VI 4-1995

Sarasota
Atlas Construction, Inc.
1027 N. Washington Blvd.
P. O. Box 1418
PHONE: RI 7-0727

Tallahassee
J. H. Dowling & Son
705 W. Madison
P. O. Box 308
PHONE: 2-2616

Tampa
Atlantic Steel Co.
4126 N. Armenia Ave.
PHONE: RE 6-3563

GEORGIA

Albany
Dixie Const. Co.
216 S. Mock Road
PHONE: HE 5-4011

Atlanta
Atlantic Steel Co.
Steel Bldg. Div.
1300 Mecaslin St., N. W.
P. O. Box 1714
PHONE: TR 5-3441

Augusta
M. H. McKnight & Son Const. Co.
1490 Wrightsboro Rd.
P. O. Box 63
PHONE: PA 4-8208

Brunswick
F & H, Inc.
P. O. Box 960
PHONE: AM 5-2641

Macon
Dixie Metal Co.
2014 Riverside Dr.
P. O. Box 1002
PHONE: SH 3-7437

Savannah
Savannah Iron & Fence Corp.
East President St. Ext.
P. O. Box 509
PHONE: AD 4-5188

Thomasville
H. & H. Const. & Supply Co., Inc.
P. O. Box 576
PHONE: CA 6-5533

MARYLAND

Hagerstown
Callas Contractors, Inc.
P. O. Box 1065
PHONE: RE 9-8400

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Charlotte
Roebuck Bldgs. Co.
P. O. Box 8012
2400 Wilkinson Blvd.
PHONE: FR 5-1294

Winston-Salem
True Wall Steel Co.
738 East 28th St.
P. O. Box 4024
PHONE: PA 3-2494

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Charleston
C. C. Rhodes Lumber Co.
441 Maybank Highway
P. O. Box 3315-St. Andrew Brn.
PHONE: SN 6-1656

Columbia
Roebuck Bldgs. Co.
726 S. Edisto Ave.
PHONE: AL 4-2942

Roebuck
Roebuck Bldgs. Co.
P. O. Box 128
Highway 221
PHONE: Spartanburg 5-2401

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Chattanooga
Southern Sales & Export Co., Inc.
627 Shallowford Rd.
PHONE: OX 8-2315

Clarksville
Thomason & Reece
College at Second St.
P. O. Box 733
PHONE: MI 7-5245

Columbia
L. S. White & Co.
1118 S. Garden
P. O. Box 582
PHONE: EV 8-9123

Dyer
Stockton Iron Works
Highway 45 W., North
PHONE: 3428

Jackson
Hubert M. Owen Const. Co., Inc.
373 N. Cumberland St.
PHONE: 2-3321

Johnson City
J. E. Green Co.
Division St.
P. O. Box 270
PHONE: 707

Memphis
John Cassidy Const. Co.
801 Roland St.
PHONE: BR 6-7341

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Write in No. A127 on card, Pg. 17

WIRING DEVICES — Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc. Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

Write in No. A128 on card, Pg. 17

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Div., H. K. Porter Co. Porter Bldg. Pittsburgh 22, Pa.

Write in No. A129 on card, Pg. 17

ANCHORING DEVICES—An illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A131 on card, Pg. 17

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 10-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

Write in No. A132 on card, Pg. 17

CONDUIT FITTINGS—A new 24-page catalog, illustrating a complete line of conduit fittings, oval bodies type LB, LL, LR, and T, and lighting parts is now available from Elliott Electric Products Co., 50-30 98th St., Corona, N. Y.

Write in No. A133 on card, Pg. 17

ANTI-CORROSIVE PAINTS—Subox, Inc., Fairmount Plant, Hackensack, N. J., announces the availability of literature on their lines of anti-corrosive paints and coatings, Subox paints give protection for years and largely eliminate the need for scraping and repriming when repainting.

Write in No. A135 on card, Pg. 17

PRESSURE CONTACT SWITCH—An 8-page folder (101-K) and a 4-page folder (200-EK) are available from the Kelek Company, 59 Davis Avenue, Norwood, Mass., describing their Kam-Lok Pressure Contact Switch, open and enclosed models, respectively, for high-capacity use with current-limiting fuses for 250 and 480 volt service entrance applications from 1200 to 6000 amperes.

Write in No. A136 on card, pg. 17

CONDUIT — With Rigid Polyvinyl Chloride Electrical Conduit gaining increasing popularity in the electrical field, Kraloy Plastic Pipe Co., Inc. offers a new, complete 20-page catalog. Included are comprehensive test results, specifications information, installation instruction, corrosion resistant charts, and other valuable data. Write Kraloy Plastic Pipe Co., Inc., Electrical Conduit Division, 402 West Central Avenue, Santa Ana, California.

Write in No. A137 on card, pg. 17

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines: Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.

Write in No. A138 on card, pg. 17

CONDUIT FITTINGS — A new catalog describing their line of conduit fittings is now available from L. E. Mason Co., Boston 35, Mass. The illustrated, looseleaf-type folder contains information on design features, specifications, ordering, prices, and shipping.

Write in No. A143 on card, pg. 17

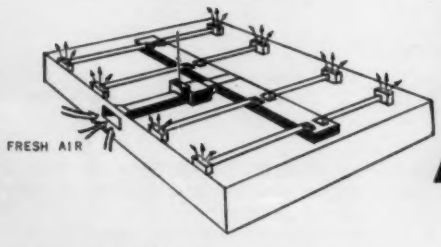
AERIAL CABLES — A 32-page booklet from Southern Electrical Co., P. O. Box 989, Chattanooga, Tenn., explains how Compresto Cables and PLM Products' "Wrap Around" spacers can be combined in a compact spaced aerial cable system. Design, voltage drop, sag and tension, and short circuit current are also covered.

Write in No 144 on card, pg. 17

WIRING DEVICES — A complete new illustrated catalog and price book is now available from E. M. Wiegmann and Co., Inc., Freeburg, Ill., covering their line of outlet and switch boxes, cut-out and pull boxes, wireholders and racks, and service entrance equipment.

Write in No. 145 on card, pg. 17

new! LENNOX *fresh air*



Controlled amounts of fresh outdoor air help make complete comfort possible.

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Beats the humidity and stale air problems common to tight, heavily insulated homes.

Gives complete comfort with accurate temperature control.

Makes air conditioning inexpensive to add—helps equalize your winter and summer load demand.

This is the heating system you can push—knowing it will benefit your customers and your company. Here's why:

Lennox Fresh Air electric heating ends moisture problems. It provides controlled amounts of fresh outdoor air to prevent dampness and stagnation. Household odors can't linger on and on. Gentle air circulation creates a refreshing atmosphere . . . *all* the heat is put to use, doesn't stratify; solar gain is distributed throughout the house. Already field reports indicate that operating costs are as much as 20% less than non-ducted electric systems.

This is a *real plus* . . . the blower, filter and ducts can be used for low cost central air conditioning. Also, advanced air filtering and purifying devices are added easily. *Your customers get 365-day comfort—you sell electricity the year around!*

Compact electric furnace—17" x 19" x 42". Zero clearance. U.L. label. 11.4 kw in two steps (39,000 Btuh). May be installed for up, down or horizontal air flow—in basement, crawl space, closet, etc. Complete flexibility of installation.

Other fresh air electric equipment

- **Heaters for individual room control**
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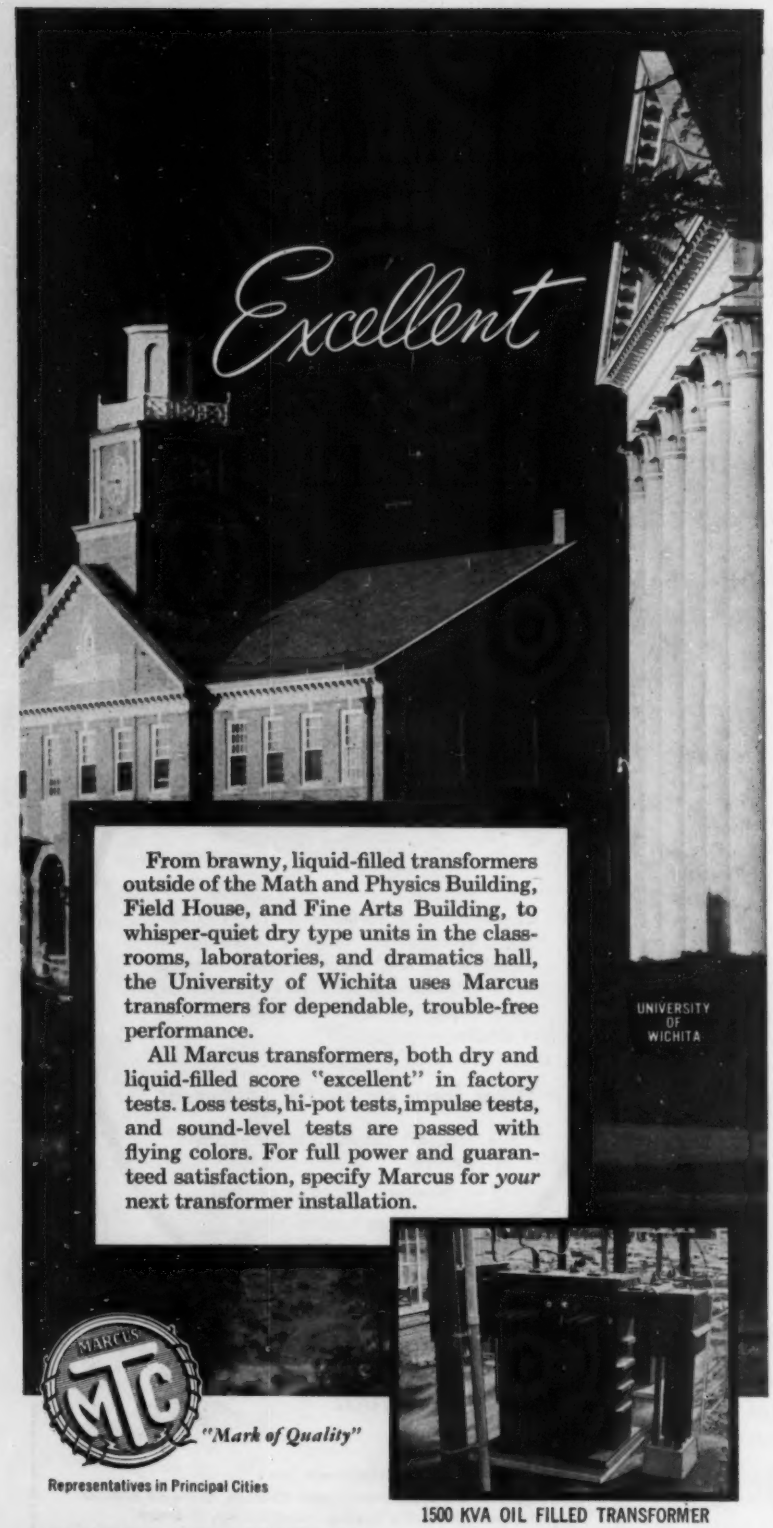

From brawny, liquid-filled transformers outside of the Math and Physics Building, Field House, and Fine Arts Building, to whisper-quiet dry type units in the classrooms, laboratories, and dramatics hall, the University of Wichita uses Marcus transformers for dependable, trouble-free performance.

All Marcus transformers, both dry and liquid-filled score "excellent" in factory tests. Loss tests, hi-pot tests, impulse tests, and sound-level tests are passed with flying colors. For full power and guaranteed satisfaction, specify Marcus for *your* next transformer installation.

1500 KVA OIL FILLED TRANSFORMER

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A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

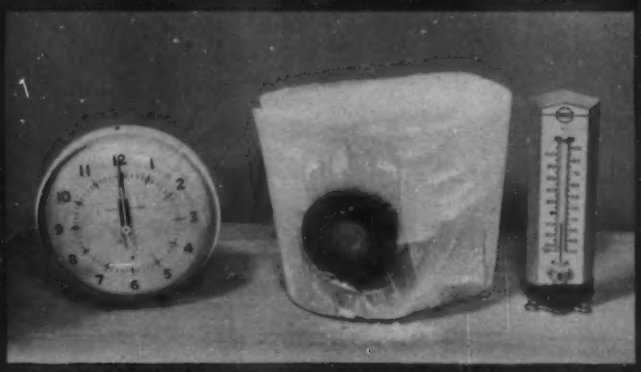
Are You Making Use of Our Reader Service?

The editorial and business staff of ELECTRICAL SOUTH is eager to serve you. One way in which we can help you is to make it easy for you to draw upon the wealth of technical and promotional material available from manufacturers.

In the accompanying pages are the descriptions of scores of useful catalogs, application information booklets, and technical publications. These are available without charge.

Check over the list of publications available, indicate the numbers of the ones you want on the postage-paid card to be found on page 17, and mail it to us with your name, title, company and address plainly written. We will tell each manufacturer to send directly to you the information you want.

WHEN IT'S COLD - THE SPLICE WILL HOLD WITH SLIPKNOT CW VINYL ELECTRICAL TAPE!



A roll of Slipknot CW is frozen solid in a block of ice at 14° F below zero.

Tape is broken out of ice . . . still at 14° below . . .

and in this frigid atmosphere remains completely flexible — strips perfectly from roll — even with ice still imbedded in the core.

At 14° F below zero, this remarkable vinyl tape

- Strips easily from the roll . . .
- Remains completely flexible . . .
- Sticks down instantly — molds perfectly — holds permanently!

Try it in your home freezer — write for a sample roll on your letterhead today!

35 seconds later perfectly conforming splice is made. Temperature . . . still 14° below!

TAPES BY
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS

To help you promote your biggest year in electric heating

Electromode's Complete For The

Profit Partnership Program offers a new avenue of approach in selling electric heat to the builder. It's a complete step-by-step sales and sales promotion program, including specific advertising and promotional materials, sales literature, direct mail, consumer ad reprints, publicity ideas, and point-of-sale displays.

Local Merchandising Aids are all prepared—a newspaper mat service... radio and television spot commercials—all stressing benefits of electric heating. Outdoor advertising, direct mail, publicity, store identification, displays—and a new Yellow Pages program—are available.

Model Home Promotion gives you a packet of advertising materials to sell electric heat in the builder's model home. It helps you sell electric heat by helping the home builder sell his home. This special folder helps sell the builder promotional and marketing ideas and materials.

Profit Plans Kit details step-by-step sales programs for model homes, custom homes and home modernization. It includes "use the user" ideas, publicity ideas, materials and methods for utilizing promotions and advertising. Gives full details on ordering Electromode promotion materials.

FOR YOUR COPIES OF THE ELECTROMODE PROFIT PARTNERSHIP PROGRAM

see your Electromode representative or send $1.00 to cover cost of handling and mailing to: Electromode Division of Commercial Controls Corp., P. O. Box 1052, Rochester 3, N. Y.

New Sales Aids Program Electric Heating Field

MODEL HOME PROMOTION KIT includes seven big aids.

Model Home Promotion Kit helps you sell the builder . . . helps the builder sell his homes. It gets electric heating in on the ground floor with promotion-minded builders. Here are some of the items it includes.

1. **Suggested Newspaper Ads** . . . three layouts to focus attention on all-electric model homes in your area.
2. **TV Spots** . . . 20-second spots to be used by the builder, promoting electric heat.
3. **Outdoor Signs** . . . stop traffic outside, direct people into and through the home.
4. **Wall Signs** . . . for use near electric heating units to pull prospects to the product.
5. **Wall Chart** . . . lists 10 reasons why electric heating is an economical buy.
6. **Utility Heating Cost Estimator** . . . gives prospects an estimate of year-round utility costs.
7. **Floor Plan Sheet** . . . individually tailored to show floor plan of the home . . . promotes electric heat. Prospect may take this home.

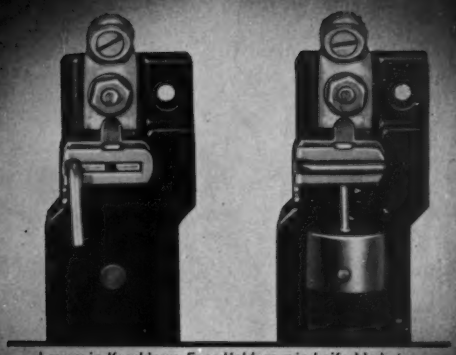
Electromode®
570 CULVER ROAD
ROCHESTER 3, N. Y.
DIVISION OF COMMERCIAL CONTROLS CORPORATION

Kamklamp Fuse Holders in

FRANK ADAM

SAFETY SWITCHES

prevent loose connections that generate heat



Levers in Kamklamp Fuse Holders grip knife-blade terminals between vise-like case hardened steel jaws; ferrule terminals under tightly drawn steel bands. Eliminated are connections that loosen and burn.

KEEP PACE WITH ELECTRICITY

See our catalog in SWEETS

THE PRODUCERS' COUNCIL

Kamklamp Fuse Holders—*exclusive* in Frank Adam Switches—lock cartridge fuse terminal immovably in position, and provide tight, flexible connections under constant tension that will not become loose and heat up. Overloads cause heat and expansion, then subsequent cooling and contraction, which loosens ordinary contacts making them flash and burn. Kamklamp Fuse Holders help eliminate this major cause of trouble.

Another Frank Adam exclusive is the rugged Shutlbrak® switch mechanism that won't arc or pit. Pre-shipment testing under loads twice the rated voltage plus 1000 volts—front handle operation that permits space-saving side-by-side installation—one piece molded pole units—these are only a few of the features that make Frank Adam Safety Switches the industry's best buy. *Write for catalog.*

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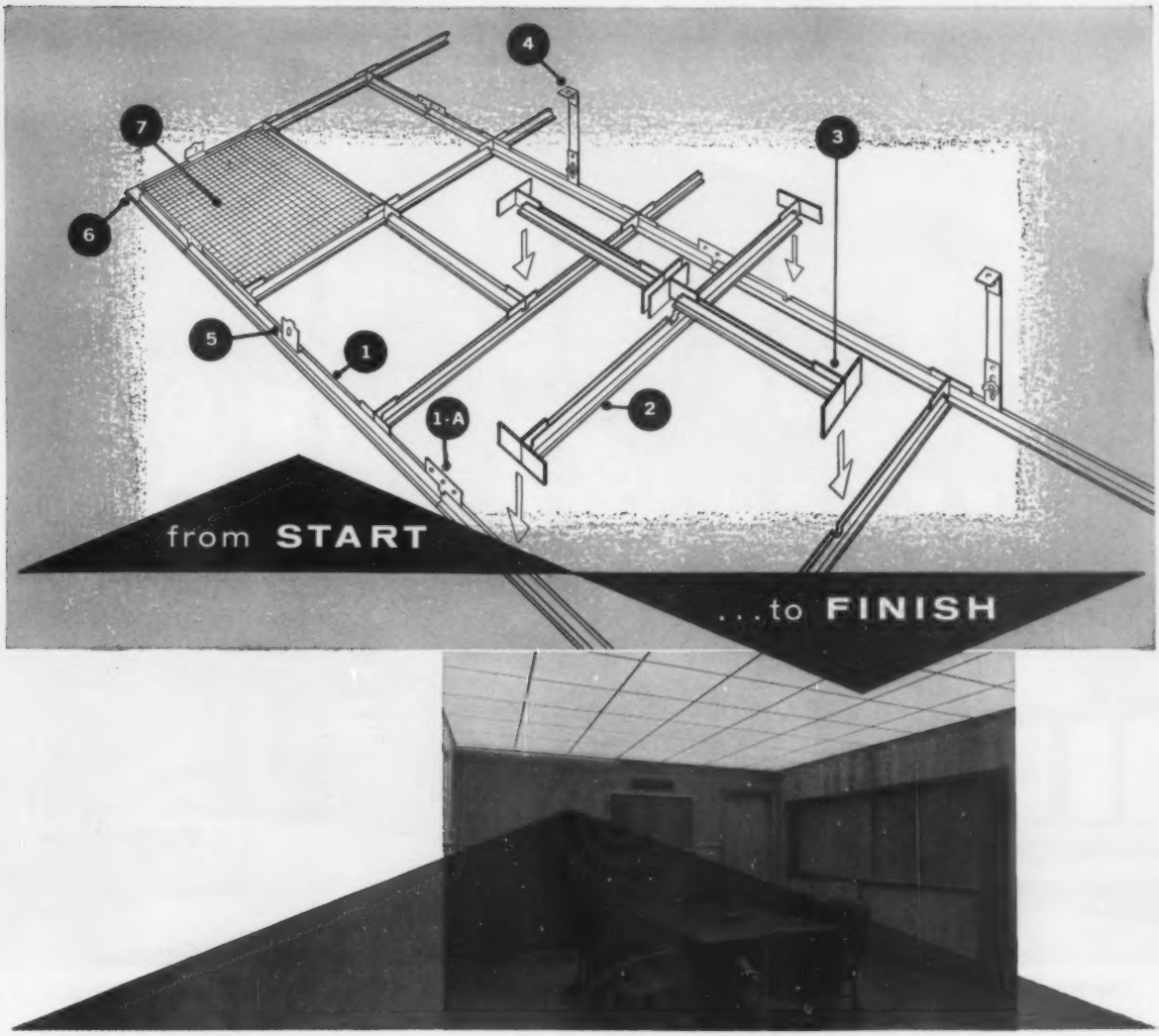

GUTH GRATELITE CEILINGS GO UP WITH EASE

Louver Diffuser*

EASY!...TO INSTALL,
RELAMP AND CLEAN!

Each operation is completed in seconds: The "slip-fit" Una-Tees **1** snap together with Tee Joiners **1-A.** Spacer Bars **2** snap into slotted Una-Tees. Tee Connectors **3** form "clutch-tight" connection between Una-Tees and Spacer Bars. Sliding Hangers **4** use only one screw at top to carry the load...and offer almost complete vertical or horizontal adjustment! Wall Clips **5** secure Una-Tees to walls. Corner Trim **6** snaps in place to make square corners. Contractors tell us that GrateLite Ceilings require 0.06 to 0.09 man-hours per sq. ft. GrateLite Panels **7** drop into place . . . your choice of 2' x 2' module Non-Combustible GrateLite...16" x 48" module Standard or Mystic GrateLite**. For round or curved perimeters — Una-Tees **1** can be bent to fit and may be cut to any length required. Four-sided support assures permanent alignment of all panels. To relamp or clean, remove each panel separately.

WRITE FOR FREE GRATELITE BROCHURES

I. B. E. W. Union made and wired

Guth LIGHTING since 1902

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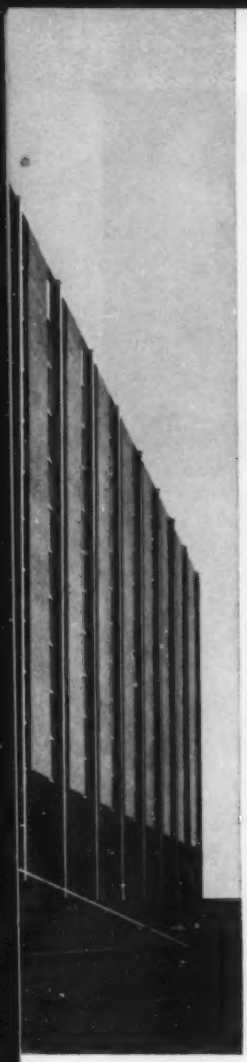
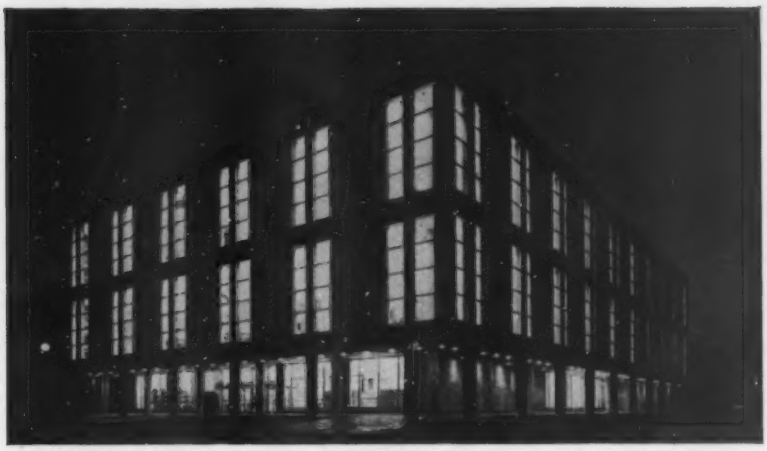
THE EDWIN F. GUTH CO. 2615 Washington Blvd., Box 7079, St. Louis 77, Mo.

Day-Brite lighting helps make the new Pius XII Memorial Library a center of attraction on the St. Louis U. campus.

Day-Brite Troffers with Cleartex® Plastic Lens Panels deliver 73 footcandles of illumination to reading areas.





Architect and Engineer: Leo A. Daly • Electrical Contractor: Sachs Electric Corp.

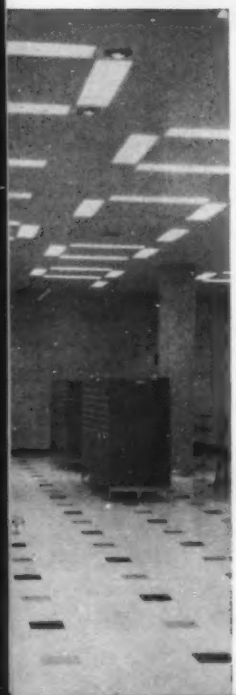
How Day-Brite lighting "sells" reading in the new Pius XII Memorial Library

From the architect's first draft to the final choice of curtains, St. Louis University's modern new library was planned with one goal in mind: to encourage students to *use* it.

Self-service, open-type book shelves were used to invite "browsing" among the stacks. "Wide-open" interior design helped create a pleasant atmosphere. In addition, comfortable bright-colored furniture was contrasted against light-colored walls and a noiseless cork floor.

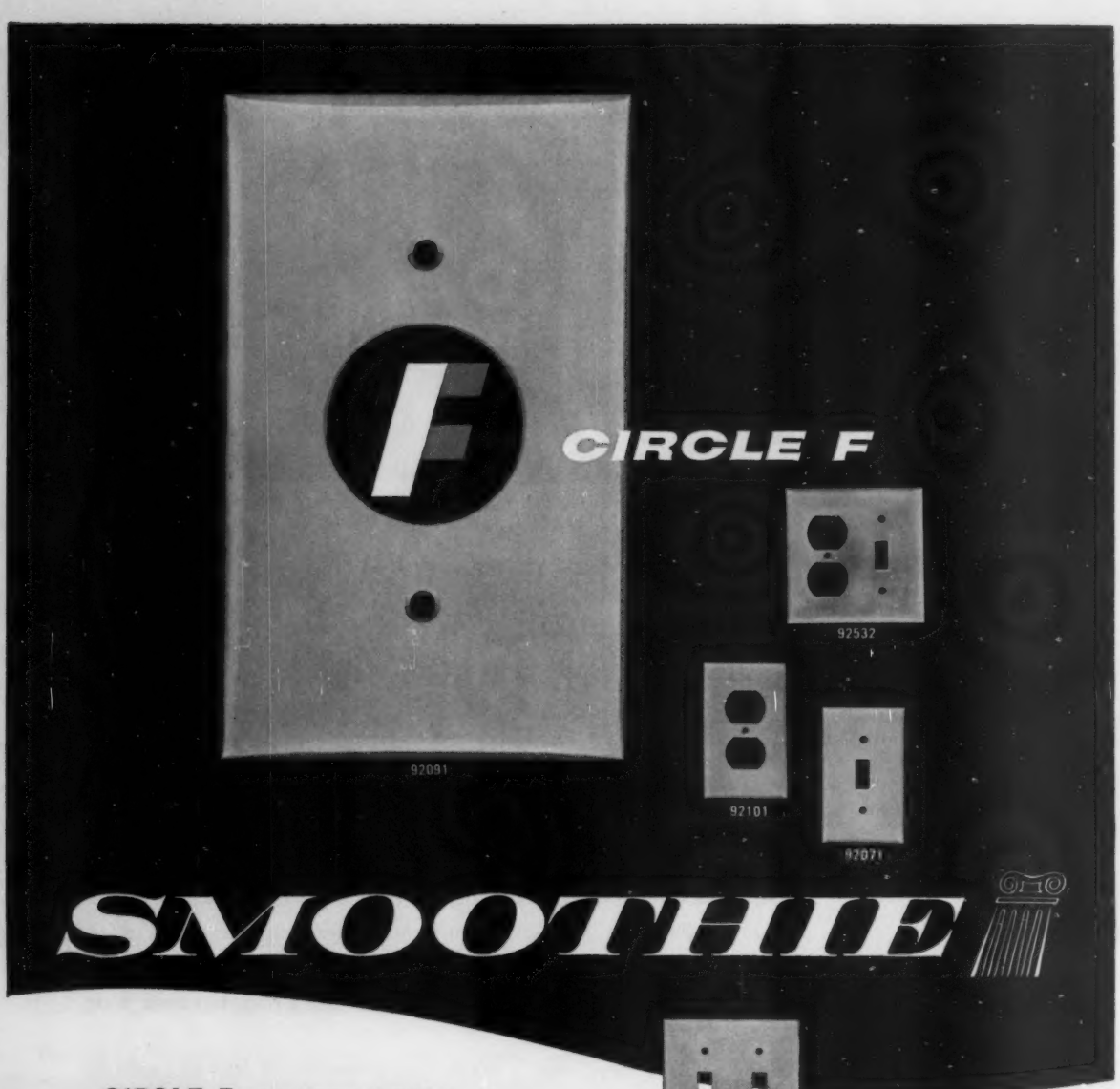
Lighting, of course, was a major consideration. It had to facilitate reading and, at the same time, add to the over-all cheerfulness. Day-Brite lighting was specified for high-level, high-quality illumination and clean, modern fixture design.

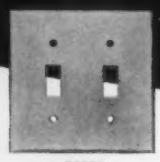
Good vision calls for good lighting. And you display good vision when you call in your Day-Brite representative early. *Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*



DAY-BRITE

NATION'S LARGEST MANUFACTURER OF
COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

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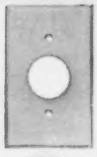
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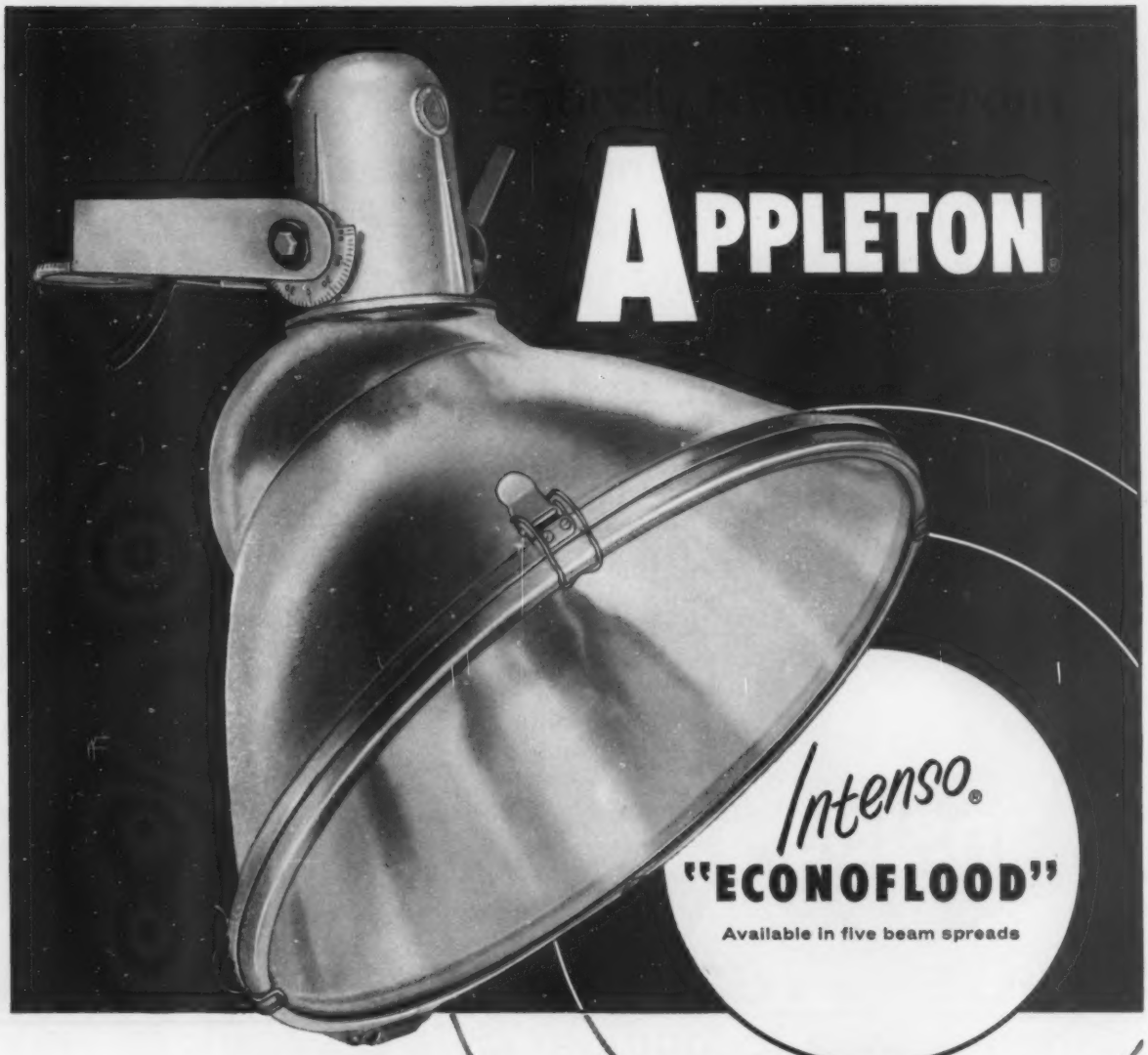
CIRCLE F's new "Smoothie" Wall Plates—smooth and clean in design—are ideal for residential, commercial and institutional applications. The completely smooth surface prohibits dust and dirt accumulation and makes these plates ideal for painting. The simple classic design with its compound parabolic curves blends well with modern or any other decor.

Moulded of non-combustible non-absorbing thermosetting plastic all Smoothie Wall Plates have reinforced rib construction to give added strength and eliminate warping. All Smoothie plates are individually packaged in cellophane and have an envelope containing mounting screws sealed in the package.

See your distributor or write us direct.

CIRCLE F MFG. CO.

TRENTON 4, NEW JERSEY



Feature for feature, Dollar for Dollar, "Econoflood" Floodlight is a Tremendous Buy!

- **Built-on locking wrench permits reversing fixture for easy relamping. Fixture snaps back into preset position when turned forward.**
- **Stepped up lighting volume . . . increased lumens!**
- **Absolute minimum condensation through air-moisture vent and filter wick!**
- **Completely weatherproofed!**
- **Finest corrosion-resisting materials, for longer life, greater efficiency!**
- **Easy, easy maintenance!**

"Econoflood" is intensely brilliant because an exclusive, self-centering inner reflector augments the primary Alzak* reflector. Has positive, locked-in precision aiming, 180° horizontal and vertical scales. It's a new high in floodlight efficiency . . . a product of Appleton's new Lighting Laboratory.

Easy, flexible installation; versatile, interchangeable accessories. Parts of quality stainless steel and pressure cast aluminum. Five efficient beam spreads cover all requirements, including plant security, sports areas, billboards and parking-shopping centers.

Sold through franchised distributors only

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APPLETON electric company

Also Manufacturers of:

* A proprietary term of the Aluminum Company of America

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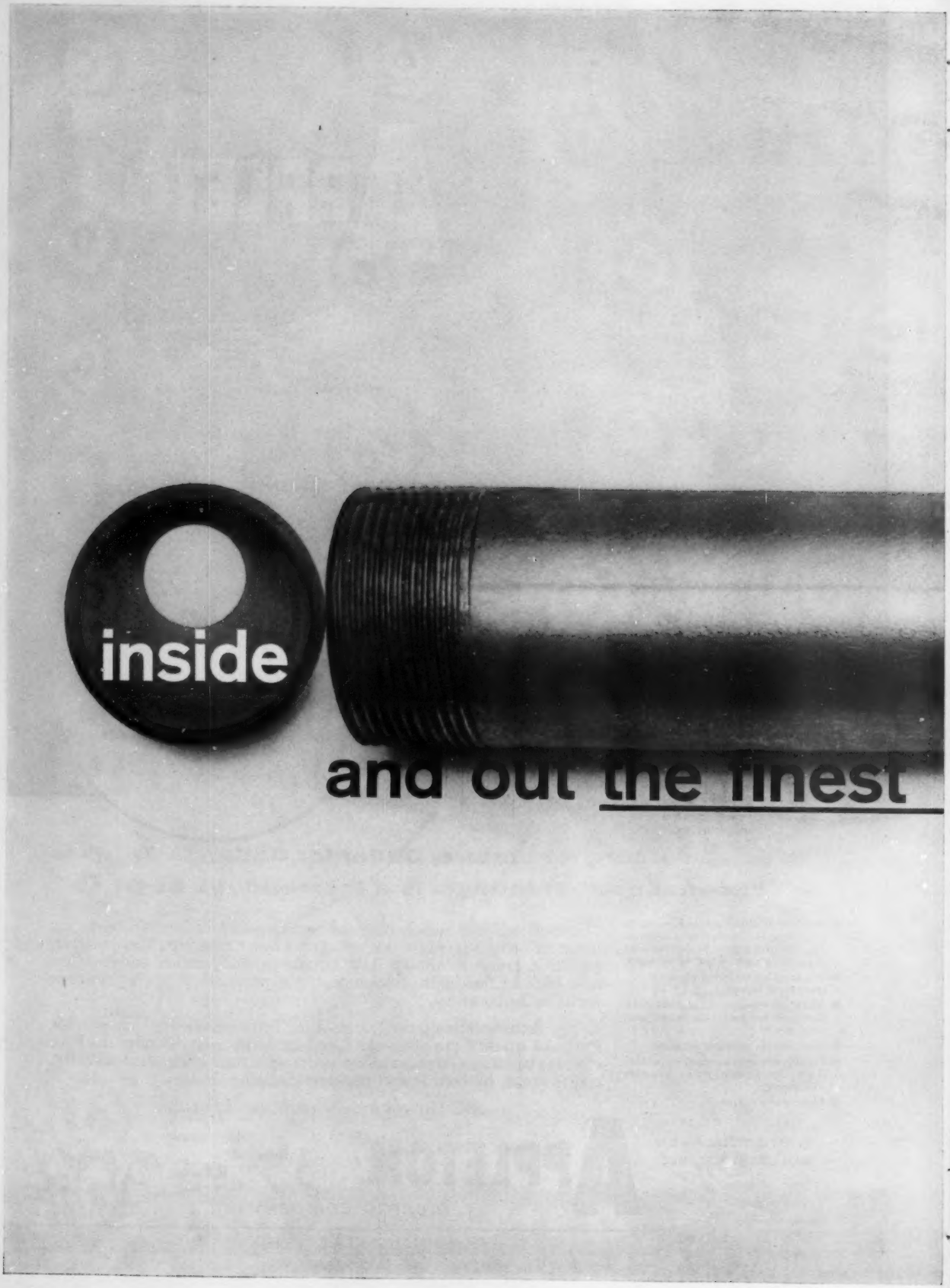
inside
and out the finest

conduit: top quality steel, hot-dipped galvanized inside and out, guarantees a uniform protective zinc covering and ensures a super smooth inner surface for fast wire pulling. threads: no mechanical wiping of threads after dipping for full zinc protection; threads are protected from damage during storage or shipping by a removable plastic thread protector. conduit and threads: chromated to give excellent protection against white rust.

rigid steel conduit available

This exclusive 3 step method of quality control production assures you of the finest rigid steel conduit for every type of installation. Manufactured in a full range of sizes from ½" to 6", General Cable's rigid steel conduit is UL approved and meets Federal specification WW-C581C and ASA specification C-80.1-1953. Sold through electrical distributors.

General Cable Corporation,
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GCC
GENERAL CABLE CORPORATION

a gentle tap...
and you'll never settle for ordinary switches again!

LEVITON A.C.
TOUCH SWITCH

Installs in any position...small enough to fit any gem box and standard wall plate ...and notice that quiet, "love tap" operation! Leviton's new 15A—120-277V. AC Touch Switch is a natural for homes, schools, apartments, office buildings, hospitals, industrial plants... anywhere! Tap it from any position, any angle!

CHECK THESE SPECIAL FEATURES:

SAFE OPERATION—install vertically, horizontally or upside down, yet a gentle tap gives positive, non-stalling action. Can't hang up...in any position. Special heavy silver contact points increase safety margin, prolong service life.

EASY INSTALLATION—side wired for convenience. Only 1" in depth. Large head brass terminal screws, backed out and staked, accommodate up to No. 10 conductors. Mounting screws are locked in straps ready-to-install. Interchangeable with any standard switch and wall plate.

HIGH CAPACITY—will accommodate high inductive loads of fluorescent systems, or full rated capacity of incandescent filament lamp loads. Take full load currents up to 80% of the switch rating for motor control.

RUGGED CONSTRUCTION—simplified construction and advanced design assure maximum efficiency, long life under heavy duty use . Heavy gauge steel plaster ear straps are riveted to housing for permanent assembly.

Creatively engineered and subjected to exhaustive "in-use" tests, Leviton AC Quiet Switches have proven themselves ideal for the new 4-wire electrical systems requiring switches rated at 277 volts. Available with brown or ivory button.

Listed by Underwriters' Laboratories, Inc. For complete details write to:

Your best jobs are done with... LEVITON

Leviton Manufacturing Co. Brooklyn 22, New York • Chicago • Los Angeles • Leviton (Canada) Ltd., Montreal. For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORP. Pawtucket, R. I.

Wanted: Manuscripts for publication

The editors of Electrical South will welcome contributions from the field for publication. Electrical contractors, consulting electrical engineers, light and power company engineers, and others closely associated with the electrical industry are invited to submit articles, photographs, and drawings relating to important and interesting electrical projects in the South and Southwest.

Articles are wanted in two principal classifications:

***Wiring and Lighting:* Articles on interesting and unusual electrical installations; any phase of electrical contracting such as business promotion, estimating, handling men and materials, etc.**

***Utility Engineering:* Articles relating to any phase of transmission, distribution, and metering, including design, installation, testing, and maintenance. These articles should be "by-line" articles carrying the name of a Southern or Southwestern light and power company.**

All articles will be given careful consideration and payment will be made promptly for all material accepted for publication.

Address all communications to the editor:

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806 Peachtree,
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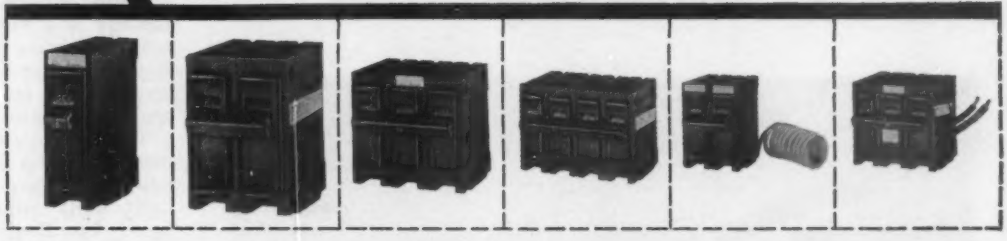
I-T-E Uni-Pak PANELS

FLEXIBILITY ...AND NOW... MORE CIRCUITS in HALF the SPACE WITH EQ·T



Uni-Pak loadcenters have long offered maximum flexibility, superior construction and exceptional features... qualities that have distinguished the I-T-E line.

Now... the EQ-T DUAL is available to make the Uni-Pak loadcenter even more flexible than ever. It's a compact, dual-breaker... two circuit breakers in a 1" case. The EQ-T DUAL is quick-make, quick-break, trip-free, with low range instantaneous thermal-magnetic tripping—miniaturized without sacrificing any of the well-known I-T-E quality.

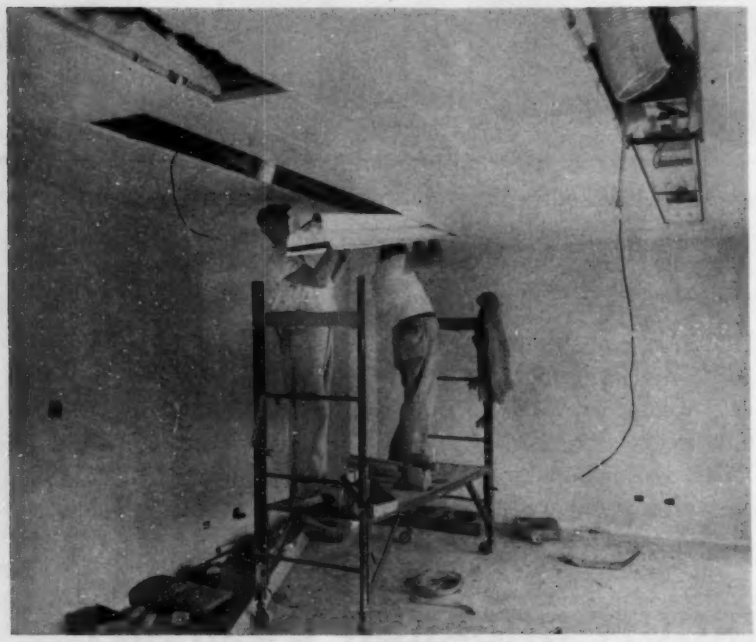
I-T-E plug-in circuit breakers plus the I-T-E Uni-Pak provide the best and most flexible loadcenter line available today.

For additional information, write I-T-E Circuit Breaker Company, Walker Division, 125 Bennett Street, N. W., Atlanta 9, Georgia. Ask for Bulletin NI-100.

I-T-E CIRCUIT BREAKER COMPANY
WALKER DIVISION

High levels, modular flexibility

The First National Bank Building ceiling has been installed and the duct work connected, but the troffers have not been put up.



Two electricians are installing a troffer in the new bank building. The lighting system was designed to provide 75 footcandles.

By Benjamin S. Benson, Jr.
Director of Research
Thomas Industries, Inc.

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ The First National Bank of Atlanta has proved itself to be a progressive, forward looking organization with the installation of a lighting system devised to maintain 75 footcandles of illumination throughout its new $4,500,000 14-story building in Atlanta.

The 75-footcandle figure selected for the new Atlanta bank building will be obtained through the use of a new recessed combination lighting and air handling fixture that provides light and air conditioning from the same concealed ceiling unit.

The troffer used was a specially constructed fixture made from the new multi-purpose Lumi-Flo air-light units which are manufactured by Benjamin Division of Thomas Industries, Inc., Louisville, Ky. The light troffer employs overhead yokes connected to the tee rail on either side of the troffer rather than using the snap-in troffer of standard design. The installation provides a clean uncluttered ceiling and highly functional flexibility.

The First National Bank Building is a great addition to the city and provides additional modern office spaces that are adaptable to most any organizational needs, according to a building committee spokesman. The bank uses only the basement, first floor, mezzanine, and second floor. The remaining floors are rental space. A good portion of the total rental area was committed two months prior to the opening of the building.

features of Atlanta bank lighting

In planning the structure, the architects (Francis P. Smith, FAIA, and Henry Howard Smith, AIA, of Atlanta) selected a four-by four-foot module as the most workable solution for all design and installation elements.

Because of the possible shifting of office arrangements, it was necessary to find some means of providing heat, light, and air conditioning that would be flexible enough to operate satisfactorily without regard to future partition arrangement. Partitions may be located at the junction of each four-foot north-south module and each 12-foot east-west module, thus producing the necessary degree of flexibility in office arrangements required by the bank and tenants.

There are some 4,500 40-watt rapid-start troffers installed in the Burgess-Manning ceiling utilized in this new building. Although the architects chose the four-foot length troffer to fit the modular design of the First National Bank, the units are also made in two-foot lengths and 12 or 224-inch widths. Most of the units used were two-lamp type in the 12-inch width and all of the troffers utilize the Corning #70 glass lens.

The interior walls of the building are light in color in most areas with a reflectance of 70 per cent, while the tile floors average 30 per cent reflectance and the acoustical metal pan ceiling 80 per cent. These factors aid in providing the prescribed 75 footcandles throughout the building.

To serve the fluorescent lighting and power loads, current is delivered throughout the building at 265/460 volts. Dry tvpe, step-down transformers wired to deliver 120/208 volts serve the convenience outlets and the incandescent lighting fixtures.

Busway is used as risers in shafts and tapped at each floor level to serve loads on that floor. One duct terminates in the penthouse and serves the air conditioning equipment.

Also in the penthouse is a 75-kw diesel-driven generator which is a standby system for emergency

(Continued on page 148)

Sheet metal worker is installing an air control valve after which electricians will complete installation of lamps in troffer housing.

The Lumi-Flo installation is completed here. Module basis of design provides flexibility with respect to office partition location.

Modern home features structural lighting

By S. W. Ellis

This article should be especially helpful to the following readers:

Electrical Contractors ✓
Electrical Utilities ✓
Electrical Wholesalers ✓
Electrical Inspectors
Industrial Engineers
Consulting Engineers

Two views of the living-dining area which features three different types of lighting units: recessed units over important areas, dimmer controlled valance lighting above window wall, and a pull-down ceiling unit over the head of the dining table.

◆ LIGHTING for safety, beauty, and utility was never before emphasized so effectively, in the Little Rock area, as in the Total Electrical Gold Medallion Home, recently introduced in Ellis Acres, a new development west of the city.

In this exhibition home the Japanese - American architect George Matsumoto, professor of architecture at North Carolina State College, worked closely with the electrical contractors, Price-Fewell Electric Co., North Little Rock, to produce a home that is well lighted outside and inside.

"In planning the lighting," said Mrs. Ruth Qualls, lighting consultant for the electrical contractors, "our objective was to show people of average income that good lighting, outside and inside, can be one of the most outstanding features of a home priced under $20,000. We feel that the lighting of the Total Electric Home makes it look much more expensive and luxurious than it is.

"To achieve our purpose, we used structural lighting outside and inside, functional ceiling fixtures centrally located, and flood lights and post lights for the exterior. The day after the exhibition home was opened, we began receiving inquiries from people planning to build or remodel, and I was available to help them."

Dramatic outside lighting

The outside lighting, which gives the home a dramatic look after dark, includes a lawn post light equipped with a photo-electric cell that automatically turns the light on after dark and off at daylight. This fixture also has a weatherproof outlet for lawn mowers and other electrical appliances used outdoors.

Under the front and back eaves are recessed fixtures that dramatically outline the exterior of the house, three in front and two in back. The eaves cause these flood lights to be reflected against the house. Beyond the carport, which

is lighted with two ceiling fixtures, is a semi-private outdoor living area, lighted with structural glow light and an additional wall bracket lamp.

Across the entire back of the house is an adjoining patio, lighted with two post lamps and serviced with four duplex outlets for outdoor living. A wall bracket is placed at each of the two back entrances where light is needed for safety and convenience.

Said Mrs. Qualls, "When we talk to a prospect about lighting, we remind him that a well-lighted house is not attractive to burglars. Women whose husbands must be away from home at night especially value outdoor lighting that is easily controlled."

Redwood benches encircle three sides of the patio. Beneath the benches is decorative strip fluorescent light, to illuminate the shrubbery and flowers as well as to provide safety for walking.

At the front entrance of the house, which lets into a spacious area for entertaining, are two wall brackets. Inside, the large L-shaped space is lighted with three arrangements of light, in addition to the lamps used in the living section. Across the entire length of the living room is a line of recessed lights, with three directly in front of the built-in breakfront that occupies a section of the wall. A total of 12 such recessed ceiling units are installed in this living area.

Above the glass wall in this area, and also above the high windows, valance lighting dramatizes the furnishings. The fluorescent strips are dimmer-controlled for four levels of light.

Unusual ceiling fixture

The dining area has an unusual ceiling fixture, planned to light the head of the table. This is a drop fixture, with upward and downward components of light, controlled with a self-contained switch. The person doing the serving thus has ample light from this well-placed fixture.

The recessed ceiling reflector flood units, with 75-watt lamps, light the long hall way. The bedrooms are lighted with fluorescent light over the windows, in addition to a functional ceiling fixture centrally located.

Over the bathroom mirrors is a long line of structural light for general light and illumination at the vanity.

(Continued on page 146)

The kitchen of this all-electric home is well lighted with cove units over the work surfaces and the range as well as a ceiling fixture.

Post lights and recessed units give the front of the house a dramatic appearance at night. Back of the house, below, is also well lighted.

Lighting in general offices of Texaco's new building ranges from 97 footcandles to 108 footcandles, and follows recommended IES levels. The fixtures are mounted on a module basis facilitating changes.

Lighting an office building

By Mavis J. Green and K. E. Ping

H. E. Bovay, Jr., Consulting Engrs. Houston, Texas

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ LIGHTING LEVELS thought to be adequate a few years ago are now antiquated. This has been strikingly demonstrated by Texaco, Inc., when comparing the 100 footcandle illumination levels (recommended by the Illuminating Engineering Society) in their new 16-story addition adjacent to their original 13-story building erected about 45 years ago.

The old-timers can remember that the original lighting provided in the old building, built in 1915, consisted of two incandescent ceiling outlets per room, and the rest of the electrical system, while excellent for its time, was just as meager by today's standards. In addition to the two incandescent fixtures, there were three ceiling fans per room and two convenience outlets. The receptacle circuits in the original building were run vertically up each exterior column with one circuit per riser, making a total of 13 receptacles per circuit. The wiring, some of it still in use, was twin conductor duplex wire.

Now a new and modern building, completed in 1960, stands beside the original building. The architectural design of the exterior of the addition incorporates the Italian Renaissance Period features of the original building, including sidewalk arcade. The lighting fixtures in the new arcade are duplicates of the black iron and glass lanterns hanging under the original vaulted ceiling arcade.

Old outside, new inside

The duplication of the new to conform to the old is confined to the outside. Walking through the main entrance into the main vestibule and elevator lobby changes the period to modern times. The addition has incorporated in its design and construction such modern features as 480-volt electrical distribution; underfloor electrical raceways for telephone, signal, and power circuits; the latest in air conditioning remote temperature indication and control; lighting levels of 100 footcandles in all general office areas; complete signal and annunciator systems for interdepartmental signaling; and special lighting treatment for special areas.

The original 13-story Texaco Building was erected in 1915 and, with later additions, contained 182,000 square feet of floor space. The electrical system was first revised in 1938 to provide 120/208-volt, three-phase distribution and again in 1949 to provide fluorescent lighting and air conditioning.

Now, 45 years after the electrical system was first installed, a new addition of 16 floors with 230,000 square feet has been added and the electrical system has again been revised to incorporate the latest developments in materials and methods.

Early engineering studies showed that the combined building facility of the original and new addition required integration

The building engineer's office and control center shows temperatures, and permits changes, throughout the various zones of the building.

to new IES levels

of the electrical and mechanical systems into one unified system. Economy of operations and convenience of operating personnel were prime factors in the decision to centralize.

The basement of the original building, which contained the switchboard, transformer vaults, and mechanical equipment, was not readily adaptable for expansion and this indicated that the electrical service facilities and air conditioning equipment should be located in the new addition.

Savings effected

The need for new service facilities provided an excellent opportunity to effect savings through the use of a 480-volt distribution system. However, there was the problem of serving the existing 120/208-volt facilities. This problem was solved by installing a centrally-located bank of 120/208-volt transformers to serve the lighting and appliance load in the original building and rewinding the existing 300- and 400-hp refrigeration machine motors for 480 volts. These two machines were relocated in the new basement. The savings in switchgear, motor starters, and feeders for the new addition by the use of 480 volts was sufficient to justify the cost of rewinding the existing motors and the installation of the 120/208-volt transformers.

Additional savings were effected by the use of 120/208-volt dry-type transformers to serve both lighting and receptacles in the new addition rather than the use of 277-volt commonly used on systems of this type.

Cost estimates showed that the major savings of a 277/480-volt system occurs in the distribution system and are comparatively small for branch circuits. The 480-volt distribution was therefore utilized for the lighting risers to serve dry-type transformers on each floor.

Both lighting and receptacles are served from the same transformer, thus utilizing the diversity between loads and effecting a savings on the lighting feeder and branch circuit system. An additional advantage in this case is that the lamp ballasts in the new addition have the same (120-volt) voltage as those in the existing building.

In the power distribution system, power is supplied from two transformer vaults with a combined capacity of 4000 kva to two switchboards.

Load divided

The load is divided between the two switchboards so that one switchboard supplies all of the lighting in both the new and the old buildings, the motor load remaining in the old building, and three of the elevators. The other switchboard serves the remainder of the elevators, plus the 1700 horsepower in air conditioning compressors and the approximately 700 horsepower in auxiliary equipment.

The lighting throughout the new building is supplied from a 1600-ampere busway. All motors ½ horsepower and larger are 3-phase, 440-volt. All motors, except those driving the air conditioning compressors, are supplied from a motor control center. Motors for each of the four compressors are individually supplied directly from the switchboard. The compressor motors are 800 hp, 400 hp, 300 hp, and 200 hp. The 200-hp and 800-hp machines are new, and are started by auto transformer reduced voltage starters.

There are also two feeders serving special loads. These loads are IBM 705 and IBM 7090 Electronic Data Processing Machine (EDPM) systems. These systems operate 24 hours a day and continuity of service is essential. Continuity of service was assured by installing standby transformer capacity. Normally, each system is supplied by a separate transformer; and by a switching arrangement provided, each transformer can supply the combined systems in case of need.

A cellular type under-the-floor raceway system was installed for receptacle, telephone, and signal systems. The cellular raceway panels are spaced in a module pattern to permit flexibility of partition and furniture arrangements.

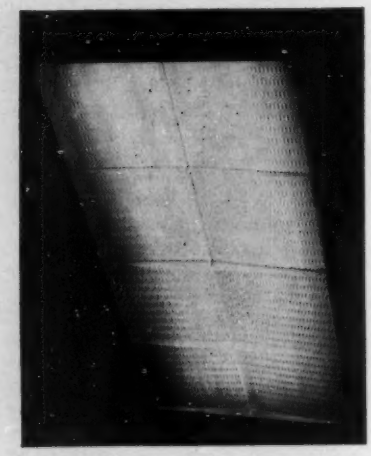
Lighting on module basis

The lighting system is also on a module basis to accommodate partition arrangement. This, together with the owner's desire for a high footcandle level low brightness illumination system, made necessary the design and manufacture of a special semi-recessed light fixture to fit in the limited clearance between the ceiling and the air conditioning duct.

The fixture was specified to meet the critical dimensions and

Switchboards in the new section serve both the old and the new buildings. Two transformer vaults provide total capacity of 4,000 kva.

The 16-story addition, at left, adjoins the 45-year old building.



Lighting units were designed for the modular suspended ceiling.

performance requirements by H. E. Bovay, Jr., Consulting Engineers, and was manufactured by Jet Manufacturing Co., of Houston, Texas. The fixture is a nominal two feet by four feet with exact dimensions to fit "T" bar spacing of the ceiling suspension system, also spaced on the partition module. The fixture utilizes the new Holophane 6024 low brightness plastic lens fitted into a specially built housing.

When mounted, the housing recesses part-way into the ceiling, giving the appearance of a very shallow surface mounted fixture. The frame has a full length piano hinge, latches to prevent light leak, and facilitates lamp maintenance. Lamps are rapid-start. The ballasts are high power factor, CBM-certified, UL-listed. They have sound rating B and operate effectively to eliminate noise. Each ballast is fused at 1.5 amperes to disconnect the ballast from the branch circuit in event of a fault and thus prevent the entire circuit from tripping at the branch circuit breaker.

Circuiting for the lighting is also arranged as a grid. Each branch circuit feeds to a junction box located at the center of a four-fixture grid. Connections are made from the junction box to each fixture by a length of flexible conduit and fixture wire. Sliding clips lock on the "T" bar to support the fixture. This permits the lighting fixtures to be readily rearranged to fit new partition layouts.

Illumination levels were designed for 100 footcandles for general offices and work areas. Measurements confirm the accuracy of the design. Special illumination effects are provided for specific areas such as banking space, executive offices, reception rooms, and lobbies.

Engineer's control center

Another modern feature is the control center in the engineer's office that indicates, and permits adjustments to, temperatures in the various offices. In addition, all motors associated with the air conditioning, heating, and water systems can be controlled from the same central location. The center panel of the control center contains a schematic of the heating and air conditioning equipment with indicating lights to show the components of the system in operation.

The panel on the extreme left contains the push buttons for controlling the equipment and adjacent to the push buttons are recording instruments for keeping permanent records of steam flow, chilled water flow, head and suction pressures, etc.

The panels on the right contain electronic remote temperature recording and indicating and control equipment. The console with the dial and switches in front of the control center provides the engineer with the means to read temperatures in any of the zones within the building as well as outside temperatures without leaving his desk.

The office of Kenneth Franzheim, Architect, prepared the architectural plans. The engineering firm of H. E. Bovay, Jr., Consulting Engineers, prepared the electrical, mechanical, plumbing, and air conditioning plans and specifications and furnished resident engineering services during construction.

Manhattan Construction Company was the general contractor, with J. S. Copeland Electric Company as electrical sub-contractor. Hirsch Electric Company was the sub-contractor for the temperature control wiring. The switchboards, panelboards, and busway were manufactured by Wilson Electric Manufacturing Co., of Houston.

The resulting building addition

(Continued on page 145)

Lighting training gets tangible results

By Harvey Nichols

Asst. Residential Sales Mgr.
Arkansas Power and Light Co.
Little Rock, Ark.

This article should be especially helpful to the following readers:

Electrical Contractors ✓
Electric Utilities ✓
Electrical Wholesalers ✓
Electrical Inspectors
Industrial Engineers
Consulting Engineers

Edward L. Linebarger, right, director of residential lighting promotion for Arkansas Power and Light, and his assistant, F. W. Griffin, set up for a typical class of their "Academy of Lighting Arts."

◆ GRADUATION CERTIFICATES were recently presented to 96 of 111 enrollees in Arkansas Power & Light Company's new 12-week training program in lighting sales promotion and education. Built around an "Academy of Lighting Arts" teaching package, this new promotional effort emphasized home market sales.

Initial results spotlight several significant factors, for example, immediate sales allies' acceptance and cooperation.

A Little Rock retail employee graduate says, "I have on numerous occasions sold larger orders through knowledge gained at the Academy. One of our biggest aids is a demonstration area my company has started using to show customers the difference in the lighting effect of each bulb and tube and their use in structural lighting as well as fixture applications."

An El Dorado, Arkansas, electric service company employee reports, "After talking to the customer and seeing the application, I decided to put my 'Light for Living' training to work. Before my training, I would have been afraid to recommend over one or two fixtures per room. However, in this case, I made the recommendation for seven recessed fixtures in the living room, with another four in the recreation room plus an extra one in the kitchen. This made a total of 12 fixtures sold instead of two. The total order, fixtures plus installation, was between $400-$450, rather than $30-40."

An El Dorado electric service company president, at first reluctant to take the lighting training, now has this to say, "I went to a customer's home to install one single pole switch and three receptacles. After talking with the customer, I decided as a result of my training that I could recommend 12 fluorescent tubes for valance and cornice lighting in the living room, three fluorescent tubes for valance in bedroom and a 12-foot soffit installation in the bathroom—a $400 sale."

A Hot Springs furniture company manager reports, "I've already checked with the sales manager at the Arkansas Power & Light Company to find out when the advertising and promotion will begin for 'Light for Living.' And I've made plans with a manufacturer for special promotion on 'Light for Living' lamps to run in conjunction with the concerted sales campaign."

229 kw load added

Home lighting consultants, five specially trained women located in three of the company's divisions, are meeting with excellent response. The consultants had made 2,161 calls, resulting in 229 kilowatts in lighting sales. "We're gathering momentum in educating the public all along," one consultant reports, "the customer now seeks us and wants to know about good lighting."

The utility customers receiving the ultimate benefit of the campaign are delighted with the lighting recommendations. A Little Rock housewife summed up her feeling saying, "Proper lighting makes all the difference in the world! Now I actually get more pleasure from doing my kitchen work—the lighting makes the rooms seem more cheerful and comfortable. It really lends a whole new personality to my home."

Groundwork for campaign

A well planned campaign lies behind these initial accomplishments. The re-emphasized lighting promotion for the home market bolsters one of AP&L's key power loads. Residential lighting accounts for perhaps 25 per cent of the kilowatt-hours now consumed by approximately 265,000 residential and rural customers.

As a first step in bringing the latest in home lighting concepts to Arkansas homemakers, two company employees were promoted from the field to head up a residential lighting staff. Edward

(Continued on page 146)

Effective lighting for

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ WHETHER SNOW is on the ground or warm nights are in the offing, many home owners are giving considerable thought to making improvements in their gardens and patios.

A sure way to derive greater pleasure from the garden and outdoor living areas is to install lighting. It prolongs the enjoyment of the garden and has other important advantages as well. Garden lighting makes it possible to dine and entertain outdoors after dark. It is also a "safety first" for it enables family and friends to watch their steps in the night. It can be a protection against unwelcome intruders, too.

Fortunately, the lighted garden is not a luxury. Miss Myrtle Fahsbender, director of home lighting for Westinghouse, emphasizes that garden lighting is economically feasible for any garden, regardless of its size or the modesty of one's budget, and for renters and home owners alike. Miss Fahsbender, who is the author of various booklets and articles on garden lighting, reports that outdoor lighting equipment is available today in a wide variety of attractive designs and prices. Installation can be temporary or permanent, as desired, and anyone can master the art of "planting" light bulbs in the garden.

If you live in a section of the country where winter covers the ground with snow, outdoor lighting enhances the white landscape as effectively as a summer scene.

Basic rules

Every gardener has his own ideas in selecting the spot or spots that deserve to be accented with light, but Miss Fahsbender says a few basic rules should be observed in carrying out the lighting plan of one's choice:

1. Avoid "whitewashing" the entire garden in imitation of daylight. The result is often flat and monotonous. The fascination of a lighted garden lies in contrasts of light and shadows, in highlights and silhouette effects.

2. Scatter the lighting units. Place them so they illuminate a flower bed, a well-shaped tree, a path, a pool, a rock garden.

3. Conceal the light source. Respect the neighbor's right to privacy and place light bulbs and fixtures so that the light is confined to your own premises. Keep the light source out of viewer's eyes. Hide bulbs in shrubbery. Or —use a shielding reflector.

4. Use white light on flowers. Colored light may be used sparingly on white statuary, walls, fences, and trellises, and is most effective in pools and fountains.

5. A little light goes a long way if directed on light-colored walls, fences, and concrete and gravel paths. They all serve as reflectors of light.

Selecting light effects

Miss Fahsbender points out that many different types of light sources are available to achieve certain effects or to obtain more

Contrasting light and shadows of concealed lamps give fascination to flowers, pools, and statuary.

Shielded bulbs are needed in locations like the one above, to keep out blinding light effects.

Some garden areas may be lighted by glass hanging lanterns. An outdoor floor lamp is also shown here.

gardens

pleasure from outdoor living. For instance, the use of bulbs which have a blue-green tint results in a cool refreshing appearance on the patio. The tinted bulbs tone down warm colors and "air condition" with light.

Bug-A-Way yellow bulbs discourage insects and thus offer the householder more comfortable living outdoors. They are recommended for porches, patios, and near barbecues.

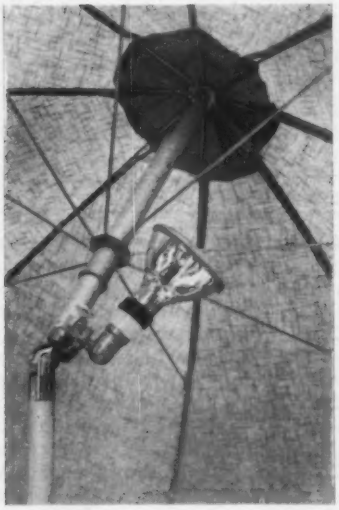
For many applications, standard household bulbs may be used, Miss Fahsbender points out, but they should be protected from the elements. PAR type projector incandescent bulbs are designed in a parabolic shape and are made of "hard" glass to withstand breakage from water when lighted. They are available in both spot and flood varieties and are extremely useful in accenting or highlighting special areas. Colortone PAR lamps may be obtained with red, yellow, green, or blue lenses.

Wiring suggestions

If you wish to landscape with light on a temporary basis, Miss

(Continued on page 145)

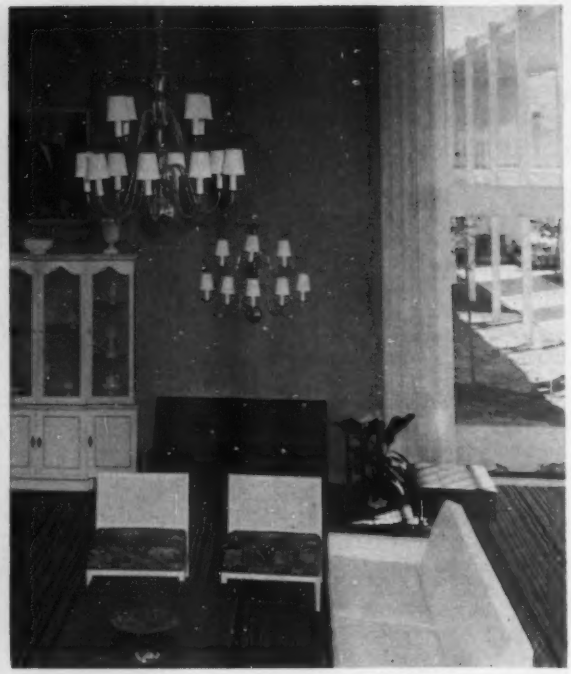
These green garden lights are inconspicuous by day, but add dramatic beauty at night. In addition, garden steps and paths, driveways, and garages are all safer when properly lighted.



This close-up of a table umbrella shows a single projector bulb attached to the main support.

This outside view of the same umbrella shows light projected through the top and reflected down from the light-colored lining. The over-all soft light effect is highlighted by bright spots on flowers.

Multicolored lights, focused upward and behind this clump of shrubs, are typical of the over-all lighting plan. No outdoor overhead lights are used.



This section of the lobby shows harmony of design between light fixtures and the room's furnishings, part of a plan that also extends outdoors.

A section of the Hilton Inn court is shown here. Night lighting is achieved by colored lights at the base of the palm trees (see far left) and by refracted light from underwater fixtures in the bottom of the pools. Small upright lamps help balance illumination.

Lighting

By C. Thomas

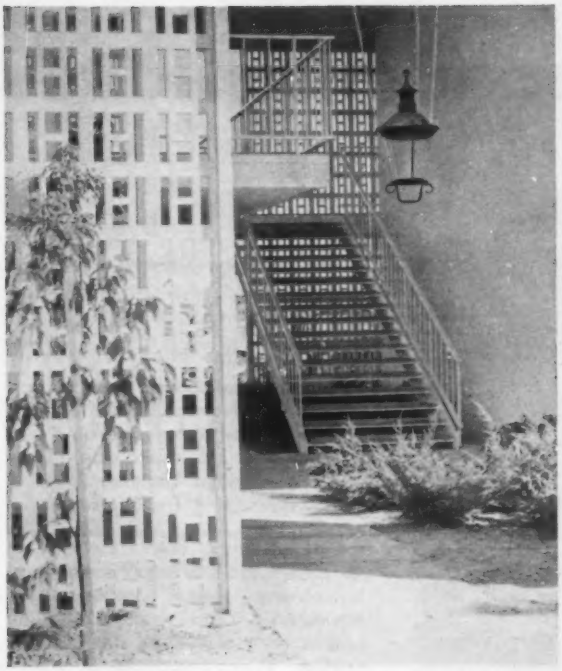
This article should be especially helpful to the following readers:

Electrical Contractors ✓
Electric Utilities ✓
Electrical Wholesalers ✓
Electrical Inspectors
Industrial Engineers
Consulting Engineers ✓

◆ LIGHTING becomes an integral element of distinction in the modern architecture of the Conrad Hilton motor hotel on the edge of Texas desert sands.

With 525 multi-colored lights beamed skyward from the base of 1,000 transplanted palm trees, the new Hilton Inn, alongside the International Airport, El Paso, Texas, offers travelers a chance to relax in a country club atmosphere.

Built at a cost of one and a half million dollars, the Inn's basic construction is glass and steel. Each



One of the collection of antique lamps is shown hanging in this entrance to the walkway. Lighting is featured throughout the Inn's decor.

View showing how console-type heat pump is located behind plate glass wall fronting the court. Air intake and discharge cannot be mixed.

dominates hotel decor motif

of the 150 units has one outside wall of plate glass, which faces the court and overlooks the swimming pools, putting green, and other facilities on the grounds. Two public restaurants and a country club are also provided.

Lighting plays an important decorative role at the Inn. One of the features is the collection of antique lanterns imported from Copenhagen, electrified, and used to illuminate entrances to walkways around the hotel.

Though no overhead lighting is used outside, lights concealed in shrubbery together with swimming pools illuminated by underwater fixtures produce artistic lighting effects at night.

Minimum wiring time

While this new Hilton Inn was designed with imagination, it was put together in a minimum of time.

"We were on this job about five months, using some 20 miles of wire to complete the job," said Charles C. "Buddy" Dunn, Jr., electrical contractor of Dunn Electric Co., El Paso.

The job involves a 480 volt distribution system, with five substations to reduce voltage to 120/208 volts. The system is housed in an underground room. All wiring is underground, utilizing direct burial cable, including the service. There are no poles, and no overhead lighting of any type is used outdoors.

Each of the 150 room units has a minimum of 12 electrical outlets. Each unit is also equipped with a combination radio-TV console and an automatic coffee server.

Individual air conditioning

In addition, each unit has its own air conditioning, provided by a console type, one hp heat pump. Guests can change the temperature controls at will, for individual comfort.

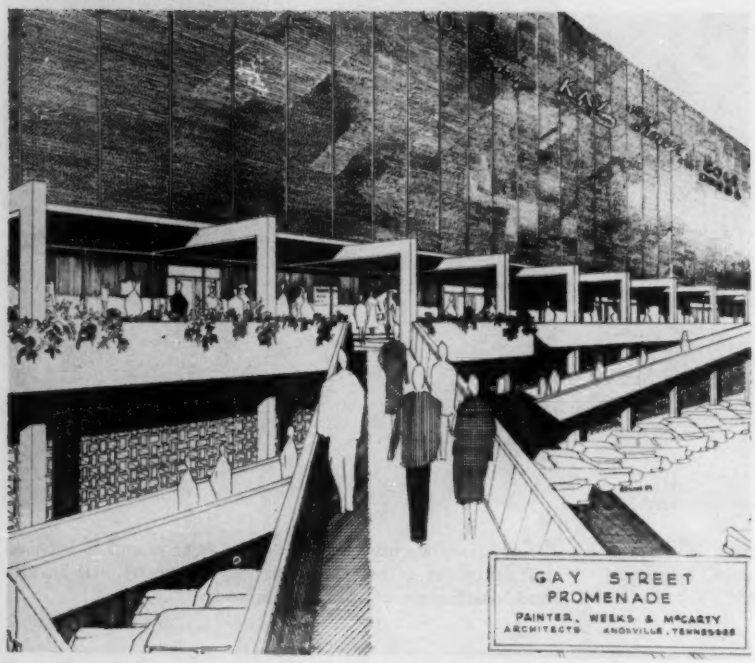
Heat pumps for heating, cooling, and circulating filtered air, have proved so desirable that the Conrad Hilton organization, builder of the Inn, placed an order for 1,500 of these units to be installed in other Hilton properties across the nation. With the individual heat pumps, if one goes dead, it does not affect or tie up the whole system.

Room units measure from 22 feet by 13 feet, 6 inches, to as large as 28 feet, 9 inches by 14 feet, 6 inches. Each heat pump has an outside grille, with the lower half used for intake and the upper half for discharging. These are designed so as not to mix air, which would cause the heat pumps to recycle.

A central cooling system with a 125 hp compressor climatizes the public areas of the Inn, including the lobby, restaurants, ballroom, and the country club, with 250 recessed lighting fixtures and 11 king size chandeliers.

"Electricity makes the newest Hilton Inn a push button operation," Mr. Dunn commented.

Lighted promenade improves



The ramp in the foreground is a moving sidewalk leading from the parking lot to the promenade. It can be lighted for night use.

At night, ten mercury vapor luminaires light the parking lot facing the promenade. The alley below the promenade is also lighted.

By Warner Ogden

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✓

◆ LIGHTING HAS HELPED a new downtown idea, completed at Knoxville, Tenn., early in 1960, and already attracting national attention. It is considered by many as an example of what other downtown areas could do to stem the trend of business moving to the suburbs.

An electrical contractor, an electrical consulting engineer, and the Knoxville Utilities Board all had a part in this development.

Twelve leading retail stores in a block in the heart of Knoxville's downtown in effect made the ugly backs of their stores as attractive as the fronts which face on the main business street—Gay Street. The stores now have new entrances and lighted display windows in back, just as in front.

Concrete walkway built

A concrete walkway over the rear alley was built—550 feet long and 25 feet wide. Concrete ramps were built leading up to it from a new block-long parking lot. There is also a moving sidewalk which carries shoppers up to the promenade, if they wish.

The parking lot was created by tearing down old warehouse buildings and the old bus terminal.

Electrical men and others from over the United States have been going to the new private enterprise project to see how it was accomplished.

Epperson Electric Company, 109 Bertrand St., Knoxville, was the electrical contractor and Fred S. Vreeland, Daylight Building, was the consulting engineer.

On the easy-grade concrete ramps up to the promenade are

downtown Knoxville stores

specially designed pole unit, vapor type fixtures. The lamps are 60-watt, circleline fluorescent units mounted on aluminum poles.

At the L-shaped top of concrete posts on the promenade are 500-watt floodlights which point to the metal screen of anodized aluminum 100 feet high and 550 feet long, covering the backs of the buildings. These light up the signs above, too.

There are also 100-watt circular light fixtures along the top of the promenade.

"The promenade is illuminated for night sales," said Mr. Vreeland. "The arrangement of lighting makes it visible at night and attractive."

Epperson, the contractor, was also called on to install light fixtures for some of the modern new entrances and show windows along the promenade.

Several of these fronts are in colored tile or colorful new metals. Robert A. Epperson has helped his electrical contracting business by taking color pictures of installations on which he works. He gives these to the customers for whom the jobs are done. "They are always pleased with the color pictures," he said.

Mr. Epperson took many color shots on the promenade job as it progressed.

Epperson Electric had its own mobile equipment trailer shop and job office on the job at the promenade to save time.

The company also has two-way radios for trucks out on jobs to keep in touch with the main office.

Besides the Knoxville office, Epperson has one at Clinton, Tenn., where it is doing electrical work on the famed Clinton High School, now being rebuilt.

Utilities board takes part

On the promenade job, Knoxville Utilities Board also had a part, because the promenade is located over the alley. The public alley, used by trucks, had to be lighted too. So KUB installed fluorescent luminaires. On 10 units

(Continued on page 143

Construction of the promenade followed demolition of a half block of downtown buildings. Included were warehouses and a bus terminal.

Roy A. Epperson, of Epperson Electric, examines a specially designed fixture used on the ramps leading from parking lot to promenade.

Profits in fluorescent lighting

By Ross L. Holman

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ IN SOME RESPECTS the Sadler Electric Company has found fluorescent maintenance one of the most satisfying revenue producers it has developed.

Maintenance is by no means the only source of revenue this Nashville firm promotes, but it has the advantage of regularity. For example, Sadler makes a contract with a commercial or industrial company, and it has a repeat customer for the duration of the contract, which usually runs one or two years, and is nearly always renewed.

Sadler has two maintenance trucks devoted entirely to keeping the fluorescent illumination of its customers in top working order.

"This maintenance activity has been in operation about seven or eight years," says Jimmy Vanns, Sadler's office manager. "We now service a list of the most important industries and retail establishments in the county. The business firms that use our services are usually those that take great pride in their operations. They realize how much good lighting facilities mean to their customers and their employees."

He mentioned such Nashville firms as one famous men's clothing establishment where quality clothing is emphasized and where fluorescent brilliance can show up that quality to the best advantage. In addition, hair dressers need the most efficient visual aids to do their best work; the same is true for doctors' and dentists' offices.

Among the big name firms are Levy's, Family Bootery, Superservice Freight Lines, Hoover Motor Express, all branches of the Commerce Union Bank in the county, several branches of the American National and the Third National Banks, the Bi-Rite chain of independent grocers, numerous drugstores, small markets, etc.

The payments by the various maintenance customers vary from a minimum of $5 a month to $200 or more per month. A special advantage of this business is that users of this service are practically all well established firms and a default in payment is so rare it is one of the least of Sadler worries.

Service routine

The maintenance workers go around to each customer once every 90 days to check the lighting and to clean the tubes. They make all the necessary replacements of defective fluorescent parts without any extra cost, since all of this is included in the contract price. If anything goes wrong in between regular checking dates they are subject to call—also without additional cost.

"Sometimes a fluorescent light loses up to 75 per cent of its illuminating power and still continues to burn," says Vanns. "The customer may not actually know off-hand that he is losing this much lighting unless he's trained to notice it. We want him to know it when it happens and to give us a call. It is to our interest to keep that lighting working at top capacity, because the user's trade and patronage depend on it. Nothing sets off his working area in the eyes of his public like ideal lighting facilities. That, of course, helps the servicer of these facilities."

Although Mr. Vanns is Sadler's office manager, the official more directly in charge of this maintenance work and the one who is more directly responsible for the satisfactory operation of the lighting is H. J. Smythe, maintenance manager.

In order to facilitate this work, and to keep the fluorescent illumination of all customers in top working order, Smythe has a two-way radio service between the office and both the service trucks in the field. Regardless of where a truck is when he wants to get in touch with it, he can contact the maintenance man instantly.

Jimmy Vanns, office manager for Sadler Electric Co., Nashville, reports indirect advantages resulting from maintenance work.

Before this two-way radio contact was set up a year or so ago, Sadler had a few serious complaints about service delays. For example, something goes wrong with the lighting on the premises of an industrial user, who has to suspend or greatly curtail his regular operations until it is restored.

The call goes into Smythe or Vanns, at Sadler's, to do something about it immediately. Both trucks may be out in a distant part of the county on their regular service routes. Before the radio communication was installed, there was nothing to do but wait until one of them called in or came back to the office, perhaps hours later.

"There have been practically no complaints from anyone since we've set up this two-way contact," says Mr. Vanns. "When a user's lights go wrong now, we get in touch with one of the field service men immediately. We will stop him in the middle of a less important service job, if necessary, and dispatch him immediately to the scene of trouble. Even if the truck is on its way back to the office, the maintenance man is sent back to the emergency job."

maintenance

Manager of the lighting maintenance service is H. J. Smythe, who speeds up trouble service with two-way radio to trucks.

The specially designed truck bodies have proved particularly advantageous to Sadler in carrying out their fluorescent lighting maintenance service. Two-way radio communication between the trucks and the maintenance manager has reduced time to handle trouble calls.

The maintenance truck body was built according to a Sadler design which was evolved after a few years of use disclosed the needs. It is lined with shelves of the right length for various lamp tubes and fixtures, as well as containers for the chemical cleaning fluids, service tools, replacement parts, etc.

While the cleaning and most of the other regular 90-day servicing is done on the job, the louvers are usually brought back to the Sadler shop for cleaning and working over.

Every maintenance contract is made subject to cancellation in 30 to 60 days, according to conditions.

No formula for charges

Maintenance charges vary from a minimum of $5 to over $200 a month, and Vanns says it is impossible to work out an exact formula upon which to base these charges. "The conditions under which our men service these contracts vary so much from place to place," he says, "we have to examine each situation individually and charge accordingly. For example, there may be on the servicing list a drugstore into which the maintenance man can go and do his work any time it is convenient for him to call. He cleans up the tubes, makes the necessary adjustments, and gets away within a minimum of time. Another store may have exactly the same number and kind of lighting fixtures, but the management may permit the servicing only at certain special times.

"Even when the service man reaches a contract customer at an appointed time agreed upon between them, he may be kept waiting for half an hour to an hour or more because the management may have something going on that prevents his working on lights immediately. Then again the light fixtures may be attached to a very high ceiling, or may be over a lot of merchandise or furnishings that make it difficult to reach them."

Mr. Vanns says Sadler has learned to weigh these different situations in a way to set a contract price fair to both parties in each case. Generally speaking, the company tries to set a price that figures 15 per cent overhead and a 10 per cent profit.

Indirect benefits noted

While Sadler's maintenance operations return some profit to the company, Mr. Vanns says that the indirect benefit is still greater. Sadler does a general electrical contracting business and the numerous maintenance customers it has accumulated throughout the county have been the source of much construction work. The maintenance customers themselves are some of the largest commercial and industrial operators of the area and frequently have construction contracts to offer. They naturally turn to the company that is already serving them on a regular basis.

Then again fluorescent lighting, maintained at top efficiency, does attract a lot of attention among non-using construction prospects who happen to see it. It not only brings in additional lighting maintenance but attracts much construction business.

Sadler does a total dollar volume of around $2,500,000 a year on all construction and maintenance. It has handled some of the largest wiring contracts in Nashville and the metropolitan area. Projects have included the Life & Casualty tower—said to be the tallest building in the Southeast, and the Nashville Federal Reserve Bank as well as housing projects.

Contractors tell how

Heavy-ups prove easy to sell when customer understands need

By Frank N. Clarke
Electrical Contractor
Arlington, Va.

◆ WE ARE DOING an increasing number of residential heavy-ups. Even during January and February, usually quiet months, we did more heavy-ups than during the same period a year ago. Spring and summer we were really busy.

One of the most fruitful sources of residential heavy-ups is the emergency call. Specializing in small work, and on call day or night, we advertise this fact in the yellow classified telephone directory. Someone has a short circuit, loose connection, or poor wiring, and we are called to repair and get his equipment back into service.

Frequently observing much extension wiring in homes, we point out that an adequate service would take care of many electrical appliances now available. Electrical living has gained considerably, we point out, and further strides in the future will certainly affect our way of living. To meet this increasing need for power, we suggest a heavy-up. We mention at the time that the prospect undoubtedly could use additional room outlets, extra receptacles in bedrooms, bathrooms, or living rooms.

We stress that extra wiring means an adequate service. If they anticipate adding two more circuits, the 30-ampere service now in use will be insufficient. We suggest a higher ampere service with three wires coming in so that there will not only be enough for carrying the present load but enough to take care of future air conditioning, dryer, or electric range they may add.

Wiring for modern living

I do not find explanation of needs so difficult to surmount as price. You usually have the customer with you until costs come up. Then I find that drawing a diagram of their room layout, with needs for each room clearly defined and indicated is very helpful. It serves two purposes: they know precisely what they are getting for their money, and I have a check on precisely what I have agreed to carry out. I refer to this drawing because it tells me where outlets are to go.

The drawing impresses customers with the amount of work required to carry out a good job. When price has them stopped even though they may be sold on need for heavy-up, I withdraw, suggesting that they think it over. I suggest they talk it over with friends or neighbors who have had such work done. I generally quote my maximum price and then drop, if I have to. During slow months like January and February, I may knock $25 off list.

Credit sometimes clinches a sale. When homeowners learn that a heavy-up may be carried out by arrangement through their local bank or finance company, they often prefer monthly payments.

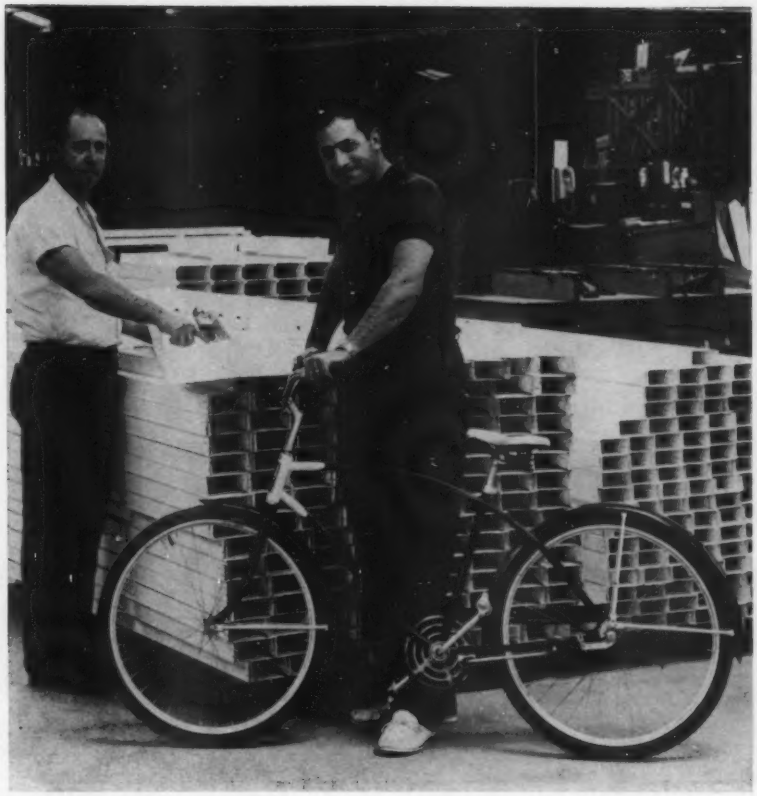
As a member of the North Virginia Electric League, I am in contact with other electrical contractors specializing in commercial or industrial work who do not handle small repairs and maintenance in residences. Often they are a source of heavy-ups when they turn down these jobs and refer customers to us.

Problems encountered in residential heavy-ups usually consist of the location of panels. A panel may be on a back porch, in a basement cupboard, in a wall, which means the old service has to be torn out and the surrounding area rebuilt in order to put our own service panel in. Sometimes an enclosed recreation room will have junction boxes hidden in the ceiling and circuits can be traced only

Frank N. Clarke cuts cable preparatory to installing a closet light in a residential wiring job.

Here, Mr. Clarke is shown installing a panel for a 100-ampere service in a private home.

Jobs for added outlets such as this one provide an opportunity to explain residential heavy-ups.



L & P Lighting Is Literally "Spinning Its Wheels" For You

One hundred and twelve thousand square feet is a lot of ground to cover. That's the floor area of our new L & P plant in Olive Branch — and that's the reason for the bicycle. We have to use bikes to scurry around the plant, filling your orders.

In a way, this bike is a symbol of the L & P spirit: We'll do anything in the world to give you, our customers, the best in fluorescent and incandescent lighting fixtures . . . and the best in service AFTER the sale, too.

L & P LIGHTING

LIGHT & POWER UTILITIES CORP.

Olive Branch, Miss.

1035 Firestone Blvd. Memphis, Tenn.

Distributed by Wholesale Dealers Only

There's an L&P *Representative Near YOU!*

For further information and prices on L & P fluorescent fixtures—standard or "custom-made"—check the following list, and phone or write the L & P representative nearest you:

(F—Fluorescent)
(I—Incandescent)

Associated Manufacturers Agents (F)
900 Carondelet St.
New Orleans, Louisiana

James E. Clary (F - I)
62 Flicker
Memphis, Tennessee

Craig-Owen (F - I)
306 E. 11th St.
Chattanooga, Tennessee

C. V. Hammon (F - I)
845 S. W. 52nd St.
Oklahoma City, Oklahoma

J. F. Hisserich (F - I)
2001 Big Bend Ave.
St. Louis, Missouri

Howard E. Johnson (F - I)
2976 Randy Lane
Dallas, Texas

Allan M. Kahoe (I)
8849 25th St.
Metairie, Louisana

Irving Milow (F - I)
415 Clover St.
Rochester, N. Y.

Richard B. Murdoch (F - I)
7300 Bailor Ave.
College Park, Maryland

William B. Murray (F - I)
531 Western Ave., N.W.
Atlanta 14, Georgia

N. B. Nichols (F - I)
2509 Bishop
Little Rock, Arkansas

Joe E. Pearce & Associates (F - I)
50 N. Kenmore
Indianapolis, Indiana

Gerald Preacher (F - I)
116 N. Church St.
Lexington, South Carolina

Irvin Spero (F)
4142 Stillmore Rd.
South Euclid, Ohio

Arthur H. Swartz (F - I)
2120 Polk Ave.
Houston, Texas

Light & Power Utilities Corp. (F-I)
P. O. Box 157
Olive Branch, Mississippi

New Plant Provides Own Proof Of L & P Beauty, Performance

The room shown above is the conference room at the new L & P plant in Olive Branch. You can see for yourself how much this artful combination of incandescent and fluorescent fixtures adds to the beauty of the room.

Every office and corridor at the new plant similarly serves as a "showroom" for L & P fixtures. Every fixture is different. A tour of the plant is like viewing a living catalog of our entire fluorescent and incandescent lines.

Next time you're anywhere near Olive Branch, Miss., why don't you drop in and see us. We're sure you'll enjoy your tour—the best proof we know of the beauty, quality and performance built into every L & P fixture.

L & P LIGHTING

LIGHT & POWER UTILITIES CORP.
Olive Branch, Miss.
1035 Firestone Blvd., Memphis, Tenn.
Distributed by Wholesale Dealers Only

DELTA

with difficulty. A ceiling may have to be torn down.

I know a large potential lies ahead in heavy-ups both in the old residence and in the new.

An ice pick or small screw driver will easily puncture the lamp base of a used fluorescent tube, thus eliminating implosion hazard.

Implosion hazard from lamp tubes

By Fred W. Goette, III
Stewart-Goette Electric Co.
Macon, Georgia

◆ BURNED OUT fluorescent tubes, particularly in the larger sizes, present a hazard to the customer when removed and replaced with new lamps. They are easily broken when handled by unskilled personnel and because of the high vacuum, implode on being cracked and scatter glass over a wide area. This could seriously injure the eyes of anyone nearby.

The vacuum in the lamp can be relieved by simply puncturing one of the lamp bases at the pin location with a small screw driver or ice pick. This simple operation takes only a couple of seconds and could prevent a serious injury to one of your customers.

Large tractor-trailers cut travel, storage, office costs

By Otto L. Pitt
Owner
Arrow Electric Co.
Amarillo, Texas

◆ MY TRAILER fleet is the difference in making a profit or losing on a job. I bought five van trailers in 1957, and later, got hold of a cheap tractor to move them. The original outlay was about $5,550—$1,000 per trailer and $550 for the tractor. I figure the saving on one two-year job I had 60 miles from town more than paid for this investment.

At the beginning I load supplies for a complete job, $10,000 or $12-000 of material rolls, on the job site at one whack. The trailers are binned, and wire, pipe, fittings, wiring devices, everything except fixtures and panels, go out on the job trailer.

This simplifies my bookkeeping; when the trailer is moved onto the job, I'm paid for everything then.

Besides this bookkeeping assist, here are some more advantages in the use of trailers:

(1) Time saver—The trailer establishes a job site, which means the men report to work at 8 a.m. I employed three men on that job 60 miles from the home base. I figure I saved $15 a day through the trailers, and over a two year period, that amounted to a nice saving; in fact it paid for the original outlay on the trailers.

(2) Tool shack expenditure eliminated—A tool shack usually costs about $300.

(3) Convenience—Each trailer is equipped with a folding table which holds rolled out plans. All loose merchandise is binned and easily accessible.

(4) Freight cost saved—The only thing that the motor freights bring to the site are the panels and fixtures, sent direct to the trailer.

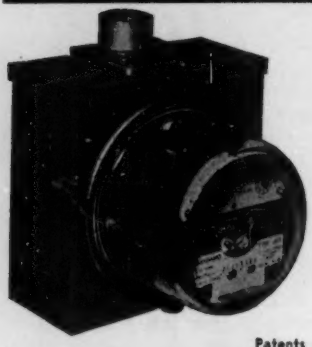
(5) Public relations—I've had numerous people tell me, "Say, I saw your trailer in . . ." some little

(Continued on page 142)

Arrow Electric's tractor and one of their five trailers is shown above. The billboard type sign advertises the firm wherever it goes, while the inside trailer space serves multiple purposes as a hauling means, storage area, and on-the-job office.

Patents Pending

CATALOG WVL-0150A-2"
Size 10½" x 8" x 3⅝"
Up to 150 Amp. Capacity



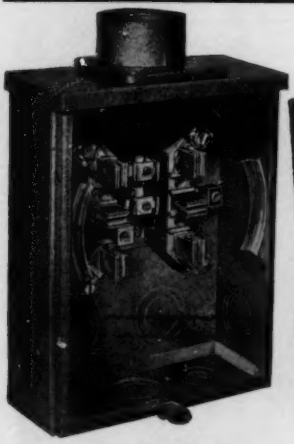
Patents Pending

CATALOG WV-011-A-1¼"
Size 8" x 8" x 3⅝"
Up to 100 Amp. Capacity

LOOKING for Something? Designed for the Application

B & C'S ORIGINAL RINGLESS METER SOCKETS
LIGHT DUTY, MEDIUM DUTY, HEAVY DUTY SOCKETS
SINGLEPHASE, POLYPHASE, COMBINATION DEVICES
HORIZONTAL GANG, VERTICAL GANG, SOCKET UNITS
INDOOR AND OUTDOOR TRANSFORMER CABINETS
COMBINATION TRANSFORMER - METER ENCLOSURES
UNIQUE TRANSFORMER MOUNTING BRACKETS
OUTDOOR AND INDOOR METERING ENCLOSURES
SERVICE MAST CLAMPS AND OTHER ACCESSORIES
INDOOR AND OUTDOOR METER CONNECTING CABINETS
METER SOCKET ACCESSORIES, PARTS, SPECIAL DEVICES

B & C's Revolutionary, Unique, Designs Flexible, and Unexcelled in Performance Keeping Pace With the Electrical Industry



Patents Pending

CATALOG WVL-0175A-2"
Size 10½" x 8" x 3⅝"
175 Ampere Capacity
3-Gang Ground
5th and 6th Terminals
Added Line Terminals for
connection to other sockets

Patents Pending

CATALOG WVL-1007-A-2"
Size 10½" x 8" x 3⅝"
7-Terminals — 100 Amp. Capacity

Write for descriptive catalog containing installation data and current price list.

B and C

Your Seal of Dependability and Safety

METAL STAMPING COMPANY

590 MEANS ST., N. W. • ATLANTA, GEORGIA

UTILITY ENGINEERING

Transmission — Distribution — Metering

Design
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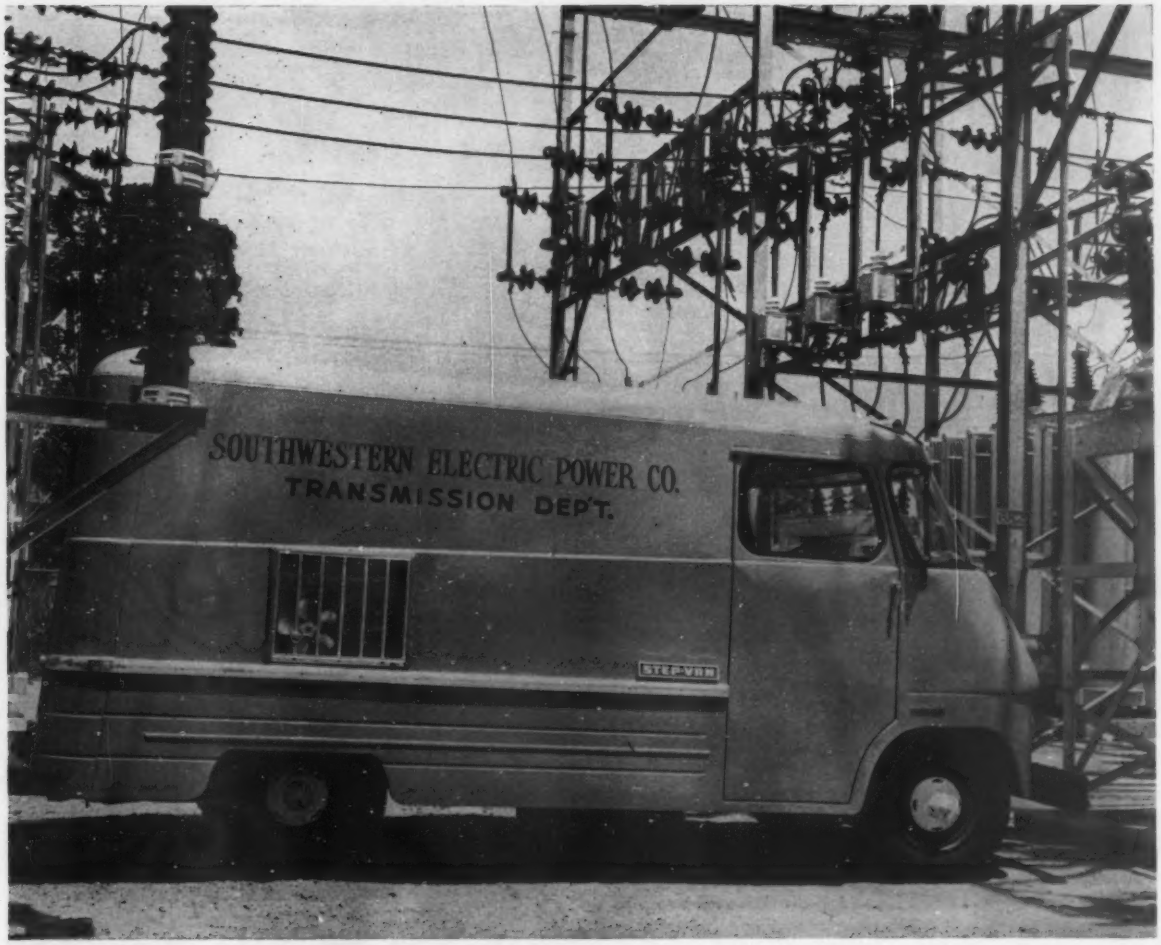
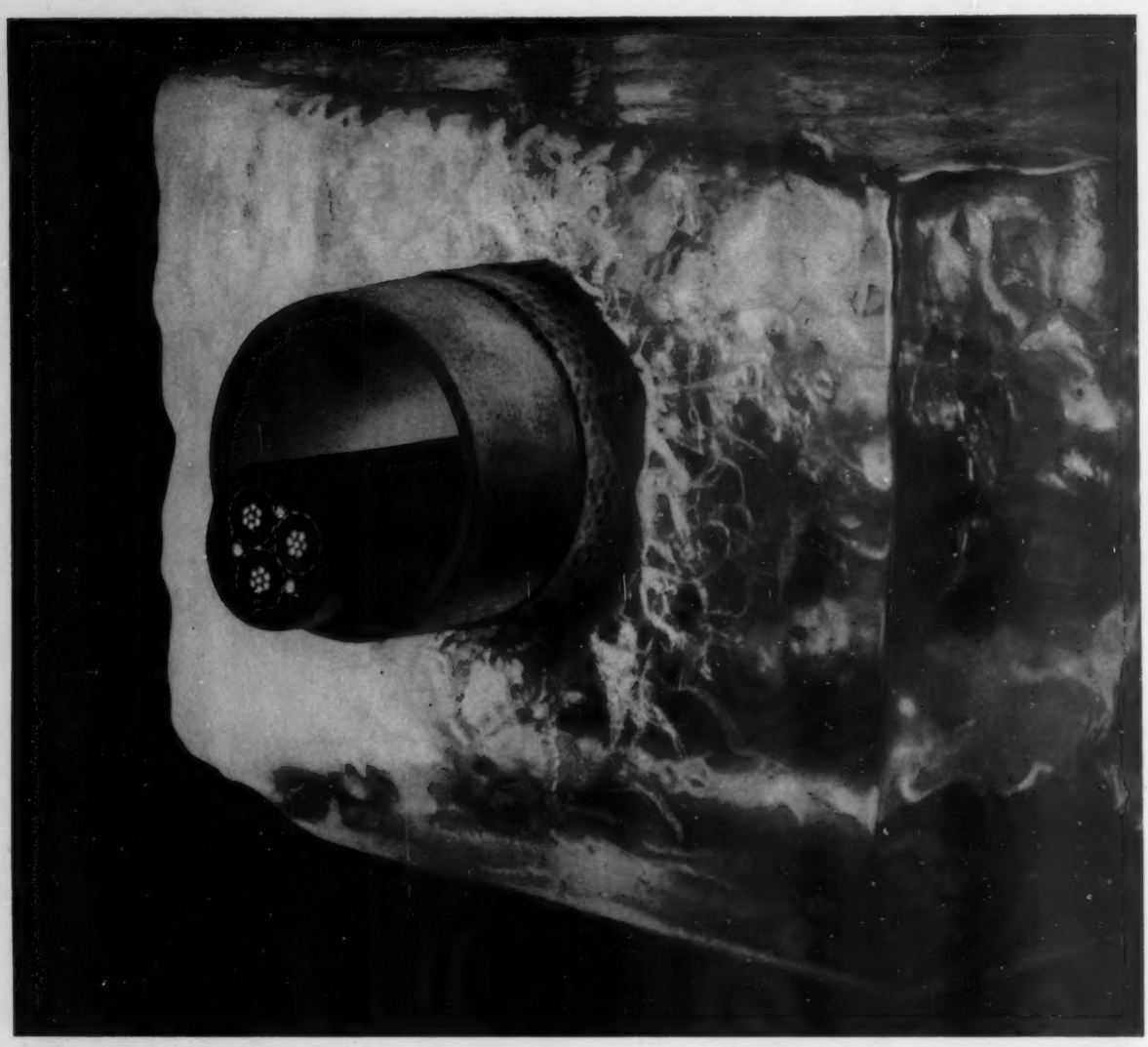


Relay test work has been facilitated greatly with this mobile test laboratory—see page 88.

Underground residential service apparatus—page 84
Grounding for substations—page 90
Methods for controlling flicker—page 94
TVA sets poles with helicopter—page 98
New utility products—page 101

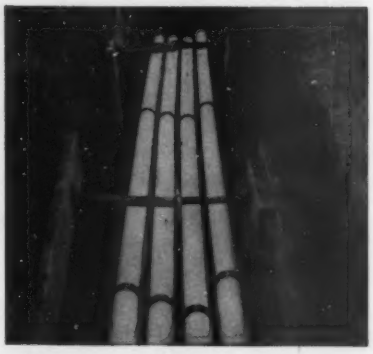


Cooler cables at lowest costs with Transite Ducts!

Do you know that electrical system losses amount to more than four hundred million dollars annually? Research shows that these losses can be drastically reduced by improving the dissipation of heat from conductors under load. The most efficient and economical way to accomplish this is with inorganic Transite® Ducts.

Tests prove that asbestos-cement Transite Ducts can actually have as much as 110.6% greater heat-carrying ability than organic ducts. This means that when a conductor is supplying a given load, its temperature will be substantially lower in Transite. These cooler cables result in lower electrical resistance with correspondingly lower I^2R losses. At a $20/KW cost, this can save you as much as $8.20 per thousand feet a year. Lower operating temperatures mean longer cable life and more reliable service, too!

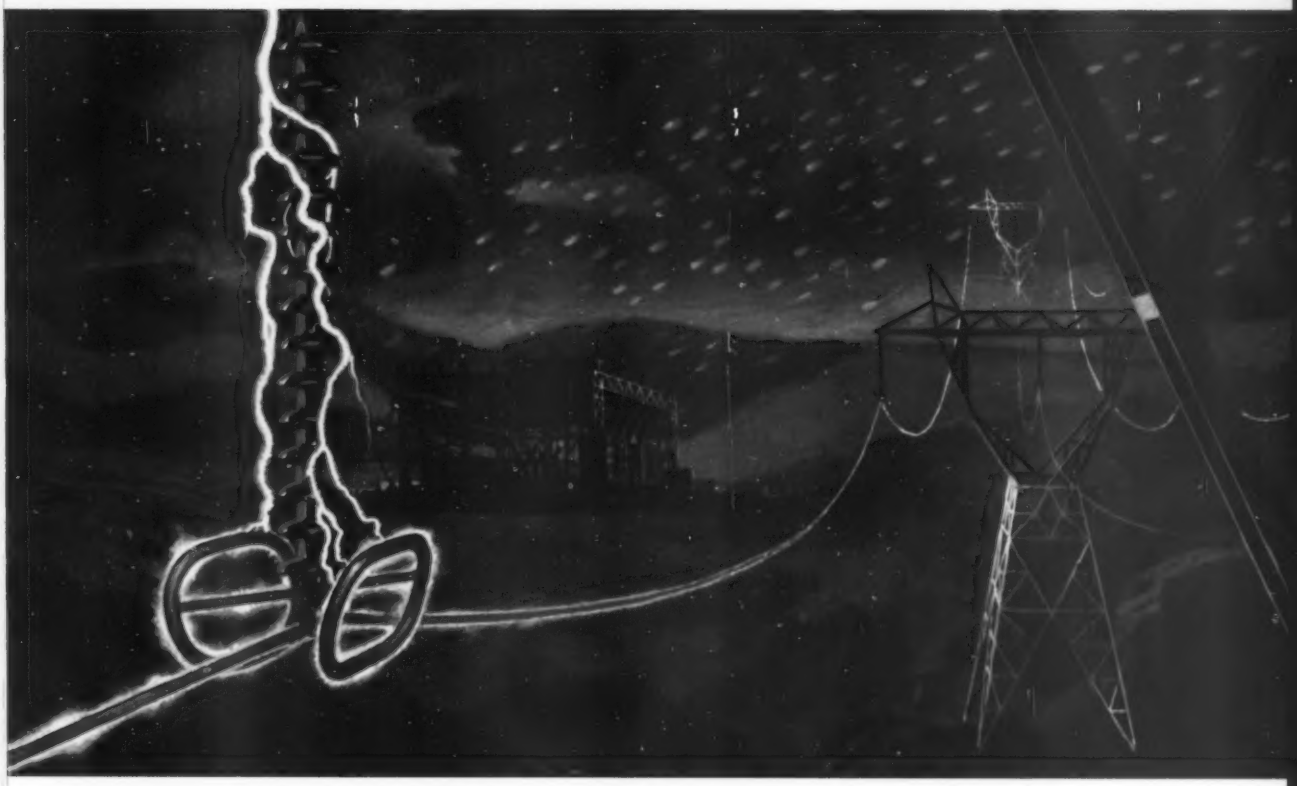
Because of their 10′ lengths and speedy coupling method, Transite Ducts can be installed at the lowest cost. Get the full story by writing Johns-Manville, Box 14, ES-10, New York 16, N. Y. In Canada: Port Credit, Ontario.



JOHNS-MANVILLE

JM

WESTINGHOUSE POWERCASTING* initiates 3 broad EHV transmission programs



predicts conquest of major problems blocking economical use of high voltage

Extends massive investigations of the last 13 years . . . helps utilities hold investment costs down

How to invest 30 billion dollars? POWERCASTING can help

Over the next 20 years, the electric utility industry will make a transmission system investment of 30 billion dollars. Much of it will be in extra-high voltage . . . because it will be technically and economically necessary to do so.

To invest on this scale in EHV systems will require a high order of long-range planning—to anticipate the right problem, make the right decisions, at the right time.

Westinghouse POWERCASTING is available to you today to do this planning-ahead job . . . to do it thoroughly and with scientific accuracy. POWERCASTING, through broad system investigations and problem solving, can help you plan your transmission system expansion . . . economically, and now.

POWERCASTING continues to search problems for solutions . . . to accelerate Westinghouse lead in EHV research

Westinghouse is currently attacking three primary problem areas:

1. Radio influence and corona loss.
2. Lightning flashovers.
3. Switching surges.

Important new programs are underway in these areas.

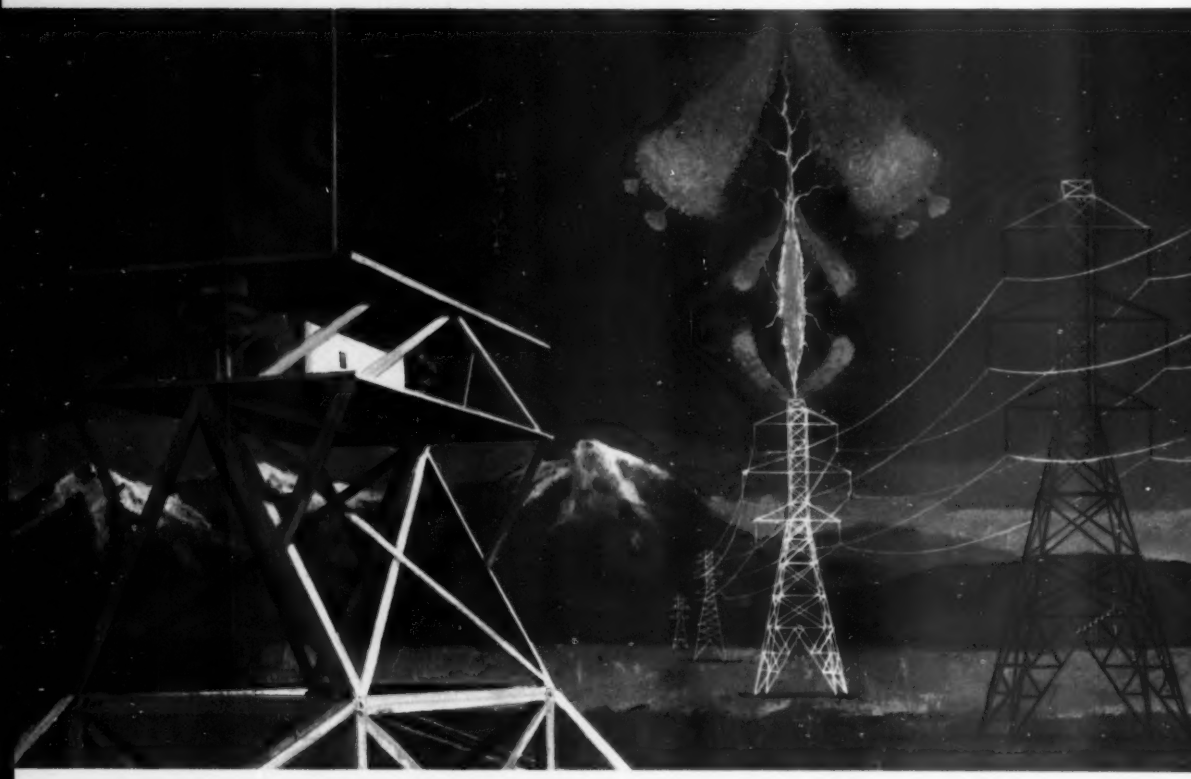
EHV research is not a new area for Westinghouse. The current programs are based on broad investigations that began as far back as 1947. The Tidd project, begun in that year with the American Electric Power Company, proved that transmission voltages up to 520 kv could be reliable and practical.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S **Westinghouse**

WESTINGHOUS
POWERCASTIN

joins with high-voltage studies



The Leadville tests, begun in '56 with the Public Service Company of Colorado, are providing valuable data on performance of EHV lines at high altitudes.

These studies provided much of the technology for building today's EHV lines.

1. New Westinghouse test line probes secrets of radio influence and corona loss at higher voltages

A third intensive Westinghouse study of R.I. and corona is now underway.

At Trafford, Pennsylvania, Westinghouse is building a special line to study fundamentals of corona formation, generation and control of R.I. and the development of new measurement techniques. The knowledge gained from this test line will be applied in a new large-scale test program.

These studies will permit the design of EHV lines above 500 kv when POWERCASTING indicates their need.

2. The lightning surge problem...Westinghouse Prestrike Theory

From intensive studies of the lightning stroke mechanism, Westinghouse has evolved the new and
tionary Prestrike Theory. According to this
the tip of the lightning leader contains a large
which is rapidly injected into the transmission
The result is a high-magnitude, short-duration
—prestrike current—producing very high v
across the insulator string. The prestrike curre
account for the higher-than-predicted outages
tain designs of EHV lines.

To determine the existence of the prestrike

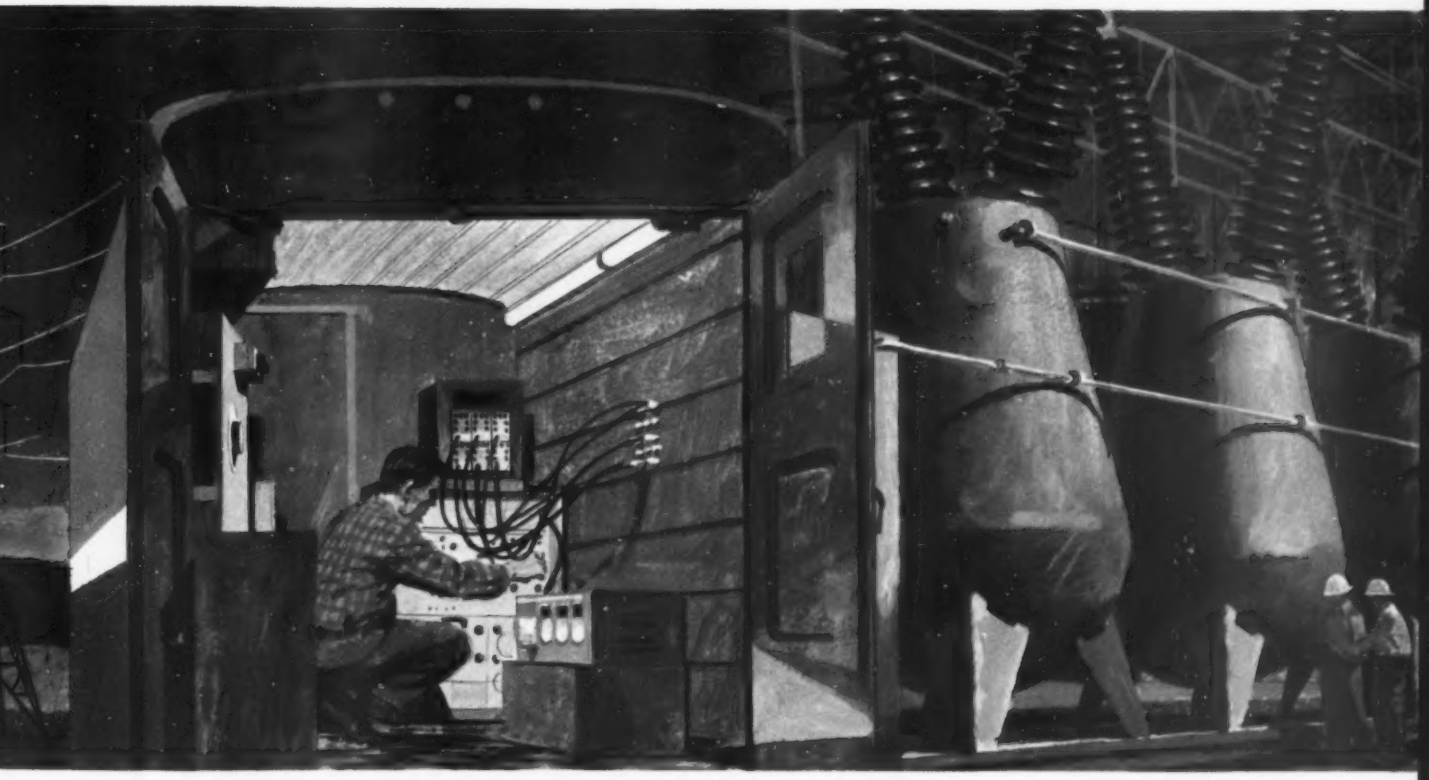
**Westinghouse developed unique current-time measur
instrument, the Kine-Klydonograph**

The KINE-KLYDONOGRAPH is one of the
unique instruments developed by Westinghc
probe the secrets of lightning. It is capable of a
measurement of the current wave shape of a
lightning stroke over a wide time range—0.0
microseconds. The records from these instrume
verify if the prestrike does exist.

The Kine-Klydonograph is mounted atop th
mission tower. Since June of 1959, 20 such instr

SE
NG*

s to facilitate economic growth of EHV lines



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have been installed on a 345-kv line, and an additional 60 instruments are being installed this year.

Westinghouse is currently focusing attention on these critical characteristics of lightning. These investigations will lead to more realistic line and equipment design and to more reliable EHV transmission.

3. Westinghouse—AEP, in two-year field test program, to make extensive study of switching surge problem

Early 1960 will see initiation of the first comprehensive survey of switching surges ever undertaken on an American utility system. Results of this survey will significantly influence the design of future higher voltage systems. The paramount insulation coordination problem for substation equipment is protection against switching surges rather than lightning.

Westinghouse and American Electric Power are cooperating in this study to measure system voltages and currents under a variety of transient conditions—line dropping, line energizations, magnetizing current interruption and de-energization, etc. Measurements will be made on 345-kv and 138-kv circuits. Total activity will involve more than 40 major field tests.

Two areas into which these test results will flow are transformer and switchgear design. Wave shape and frequency of surges are required to determine switching surge strength and BIL. Very little field data is available on switching surges which transformers may encounter. Most information on magnitude and frequency of surges has been determined by analog computer studies. Ideally, computer studies based on field test data promise the most realistic results.

New tools and new techniques have thus been made available to Westinghouse POWERCASTING . . . a program to unearth new knowledge. In this carefully balanced study program, Westinghouse will reduce present problems to a fuller understanding of switching surges . . . leading to system design ideas that will lower utilities' EHV transmission investment.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING*

can help you plan your system expansion ...economically, and now

Westinghouse POWERCASTING is a two-fold plan of action, designed to meet the modern problems of the industry.

HERE'S HOW YOU AND YOUR CONSULTING ENGINEER CAN PUT WESTINGHOUSE POWERCASTING TO WORK

At your request, Westinghouse will

. . . Send a qualified POWERCASTING team to your office.
. . . Help you outline problems and objectives of your system.
. . . Arrange a seminar to detail project specifications.
. . . Build a mathematical model of your system.
. . . Program your future system needs and equipment investment.

Only Westinghouse offers you POWERCASTING

1. A technique for more accurate planning of future system expansion.
2. A program of product development for generation, transmission and distribution geared to the needs of future systems.

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CP-1056

Litho in U.S.A.

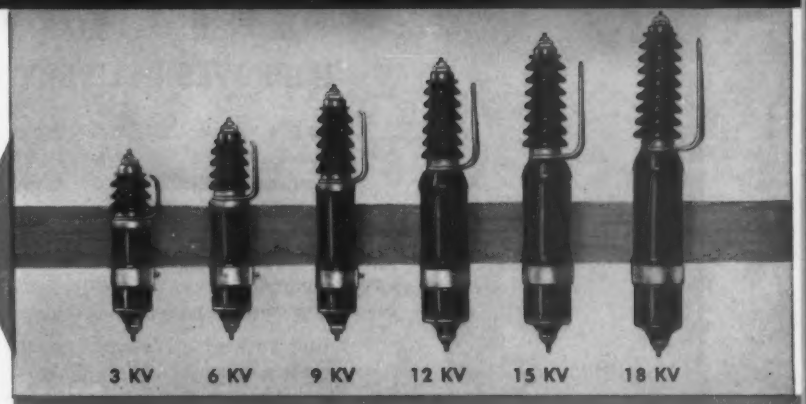
THE JOSLYN FAMILY

of distribution lightning arresters

gives you a choice

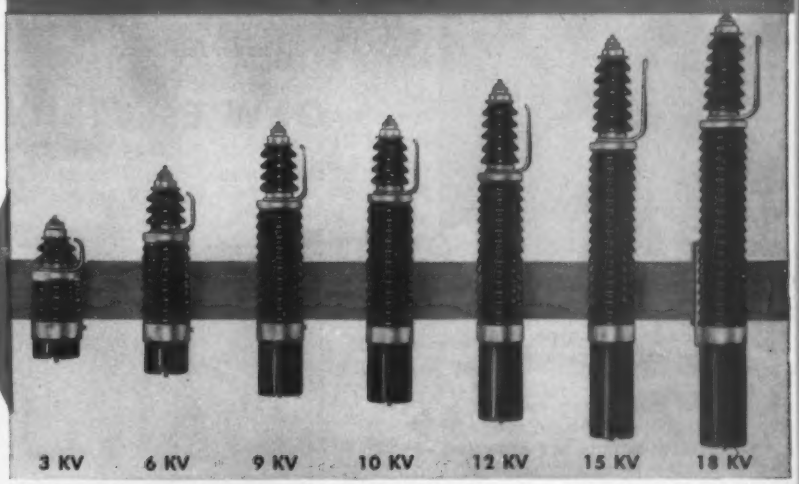
EXPULSION

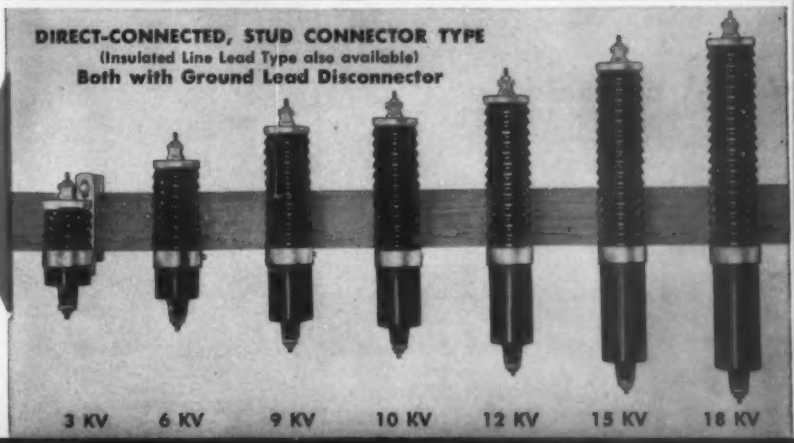
The right arrester for the job where frequent and severe lightning occurs, but where system short-circuit currents are moderate. The ideal arrester for rural areas.



VALVE

The arrester to use where high system short-circuit currents exceed expulsion arrester capacity, but where less severe lightning currents occur. The ideal arrester for dense urban areas.





Choose the Right one for Your particular needs...

JOSLYN COMPLETE POLE LINE EQUIPMENT ®

JOSLYN MFG. AND SUPPLY CO.

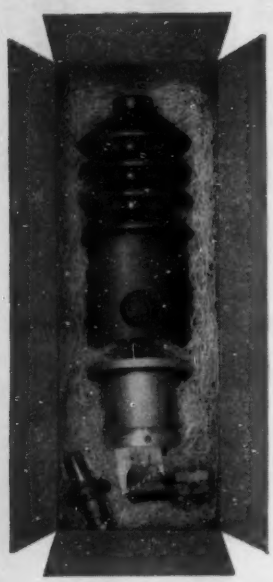
155 North Wacker Drive • Chicago 6, Illinois

UNIT PACKAGING

IMPROVES DELIVERY; CUTS INVENTORY AND COSTS!

G&W's unique Unit Packaging program saves you time and money. Every component, device, and accessory required for the installation of a G&W standard Pothead or oil-filled Cutout is quickly gathered from "off-the-shelf", carefully and securely packaged, and sent to you *complete* in a single carton or crate. Once put into your inventory, it is a simple matter to take from stock as many individual boxes as required, load on a line truck, unpack right at the job site, and put the units into service in short order. You not only effect substantial savings on inventory control and handling, but materially cut installation costs.

Unit Packaging is another benefit you gain from G&W's constant development of cable accessories and switchgear. Further proof, too, that you are dollars ahead by relying on G&W's 55-year record of dependability and quality. A G&W representative will assist you in solving any cable accessory or switching problem, or write us for full detailed information.



A standard capnut pothead ready for shipment as a typical unit package.

All components and oil for three, gang-operated oil-filled cutouts are shown in this typical unit package.

G&W ELECTRIC SPECIALTY COMPANY

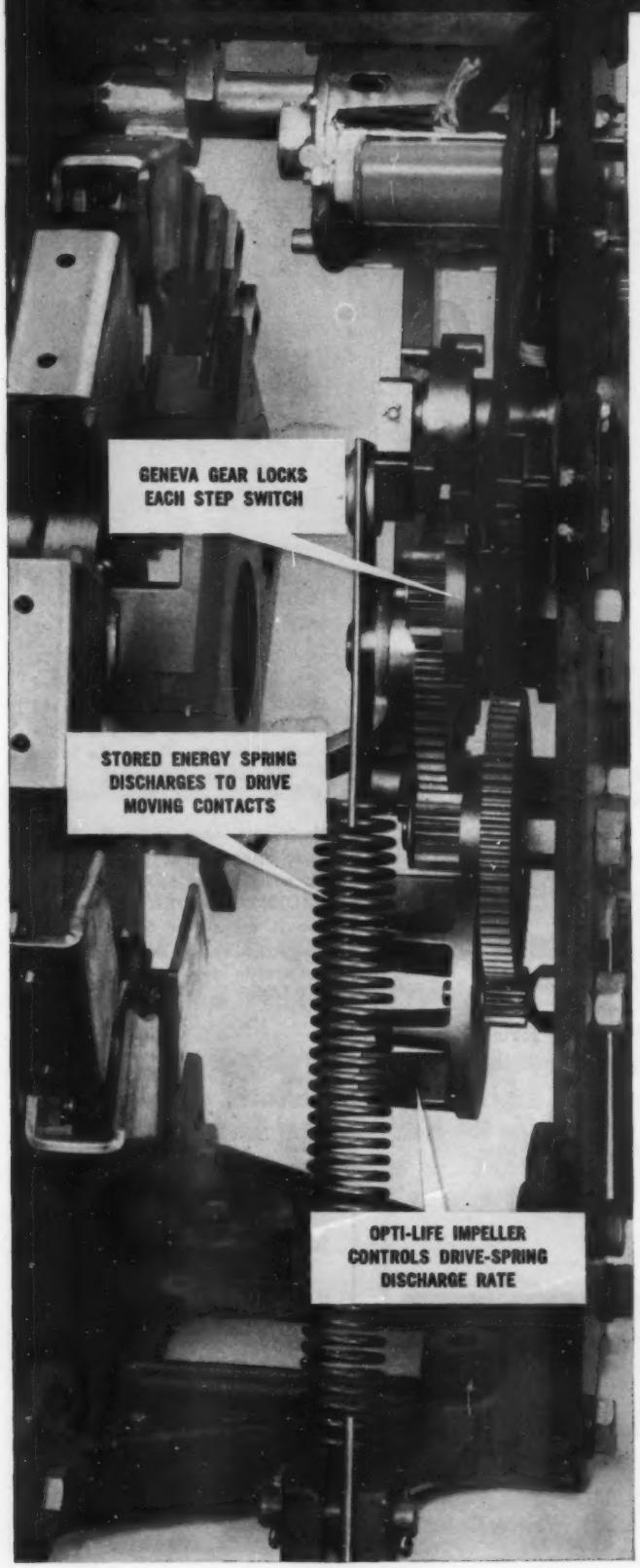
3524 West 127th Street, Blue Island, Illinois

CANADIAN MFR. • POWERLITE DEVICES, LTD. • TORONTO, MONTREAL & VANCOUVER

superior quality standards – inspired specialized design

G60-2

ANOTHER STEP AHEAD IN VOLTAGE REGULATION


GENEVA GEAR LOCKS EACH STEP SWITCH
STORED ENERGY SPRING DISCHARGES TO DRIVE MOVING CONTACTS
OPTI-LIFE IMPELLER CONTROLS DRIVE-SPRING DISCHARGE RATE

CONTROLLED REGULATOR SWITCHING SPEED

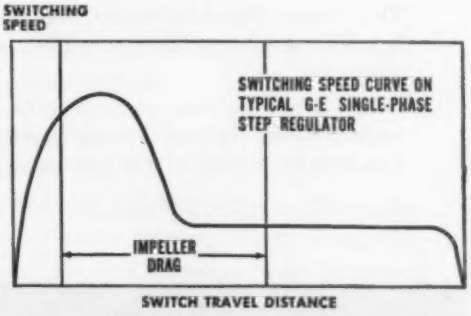
General Electric voltage regulator switches operate 20 years without inspection . . . give you maximum contact life

As regulator users know, there is an optimum tap-changing speed for maximum contact life. Optimum speed must be *controlled* and *non-linear*.

General Electric's exclusive Opti-life switch satisfies these requirements. Results: contacts "break" fast to reduce arcing. Contacts "make" at a calculated rate to (1) reduce mechanical abrasion of contacts, and (2) reduce arcing from contact "bounce."

Truly *controlled* speed of General Electric Opti-life switches is achieved by a fast-action drive, *plus* an oil-immersed impeller which dampens switch velocity as contacts close.

Benefits to you: maximum contact life. In fact, it *isn't necessary to periodically inspect* the interior of a General Electric ML-32 regulator. Under normal operation, switch inspection shouldn't be necessary *for at least 20 years*. You save money!


SWITCHING SPEED
SWITCHING SPEED CURVE ON TYPICAL G-E SINGLE-PHASE STEP REGULATOR
IMPELLER DRAG
SWITCH TRAVEL DISTANCE

FOR MORE REASONS WHY G-E regulators cost less on the line—see your General Electric regulator representative. Or, write General Electric Company, Section 456-05, Schenectady 5, N. Y. *Voltage Regulator Product Section, Pittsfield, Mass.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

SUBOX PAINTS

Corrosion protection has too long been associated with drab appearance. Now you can paint to have modern protection plus modern color styling.

Subox paints are now blended in a range of tones which make it possible to decorate property and make unsightly structures pleasing. Give your own good taste free rein.

Regardless of the colors you choose, you will be assured of the most tenacious kind of corrosion protection. Subox paints are the only American paints made with *suboxide of lead.* They remain chemically active, even after drying, to form an interlocking fibrous film that withstands the most punishing exposures.

Subox paints are very economical. One or two coats do the work of two or three of ordinary paints. And a Subox application lasts an average of 6 to 8 years.

Send for color card and literature.

SUBOX PAINTS

Subox Inc.
Trade Mark

Established 1924
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Subox Company of Canada, Weston, Ontario

YES SUH!

JUST LIKE . . .

catfish and hushpuppies, fried chicken, cornbread, and turnip greens, ELECTRICAL SOUTH is truly Southern.

It is the only magazine of its kind that is published just for you and thousands more men like you in the electrical industry all over the Southern and Southwestern states.

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Now is the time to renew, enter or extend your subscription to ELECTRICAL SOUTH. Take advantage of our special 3 year offer and get the excellent "Residential Wiring Handbook" **free.**

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Blackburn Laboratories Develop New, Improved contax

(Oxide-Inhibiting compound)

HARMLESS TO LINEMEN'S GLOVES AND IMPROVES CONNECTION PERFORMANCE

Extensive laboratory tests by Blackburn, confirmed by an independent manufacturer of rubber goods, prove conclusively that BLACKBURN'S Contax has no adverse effect on linemen's rubber gloves and blankets.

In addition, Contax gives improved connection performance. It penetrates the oxides on conductors to reduce connection resistance. It inhibits oxidation and galvanic corrosion by sealing out moisture and air from the connection surfaces.

Contax comes in crack-proof, see-through, plastic squeeze bottles. It's a non-petroleum, synthetic polymer grease with suspended zinc particles . . . has an extremely low moisture absorption rate, and is usable over a wide temperature range. Contax is non-toxic and flame resistant . . . will not harm the skin.

For detailed test data, send for Data Folder #6009.

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To keep pace with the growing market, we are now manufacturing seamless, round tapered aluminum lighting standards for street, highway and area lighting . . . in addition to our line of steel and aluminum octagonal shafts.

Full data catalog for the new line is now available. Send for your FREE copy NOW!

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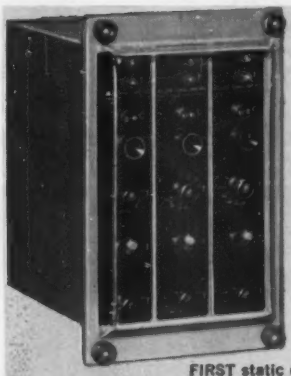
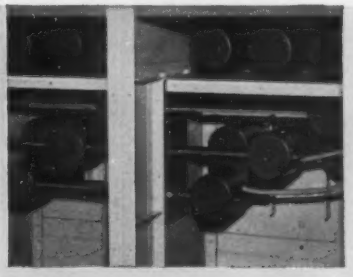
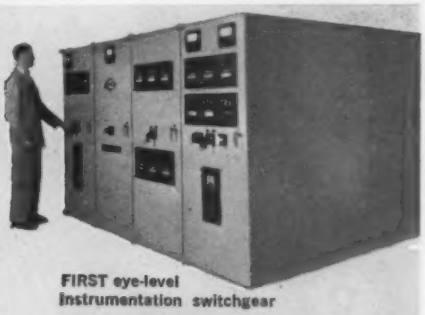


FIRST static overcurrent relays



FIRST with track-resistant, glass polyester insulation with primary stud and bus joint



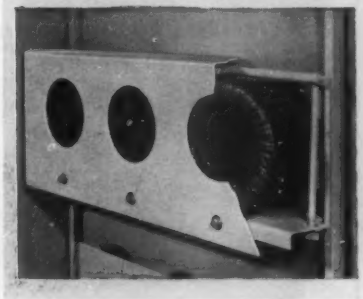
FIRST eye-level instrumentation switchgear

FIRST epoxy-resin potential transformers, trunnion mounted

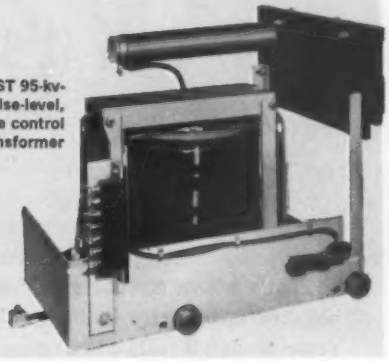
1ST

FIRST Aluma-Clad walk-in aisle switchgear

FIRST front-access current transformers



FIRST 95-kv-impulse-level, dry-type control power transformer



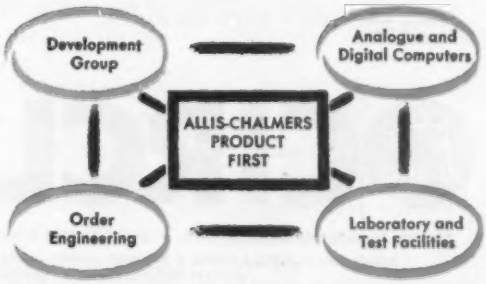
...from the company that put

Progress in Switchgear

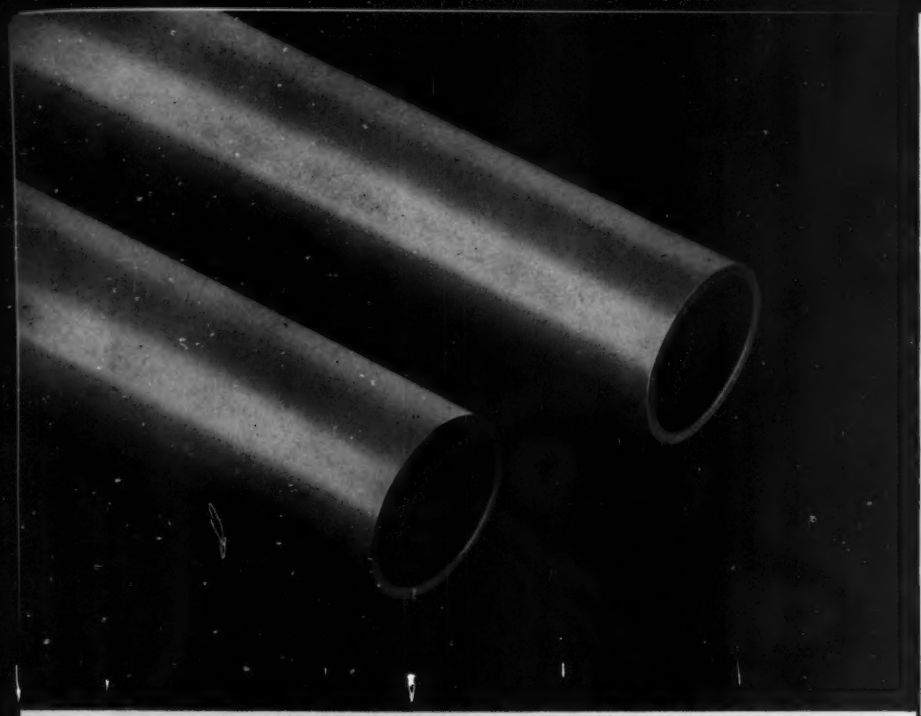
For 113 years Allis-Chalmers has built a reputation for the finest products in the industry. A-C is continuously developing new ideas, new techniques and new products to serve you better. This same leadership spirit has quickened the pace of switchgear progress. It's responsible for the firsts illustrated above. These testify to one company's research and engineering *action*.

There are still better things to come in switchgear. You'll get them all when you specify better switchgear ... designed, built and *guaranteed* by **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin. A-1357

Aluma-Clad is an Allis-Chalmers trademark.



Intradepartment teamwork bridges all gaps ... smoothly integrates information, machines and men ... speeding overall progress in Allis-Chalmers switchgear.



Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Even EMT can look good ...if it's CIRTUBE* EMT

TRUE, the first things you look for in EMT are: one, is it easy to work with—two, is it made to give lasting protection. CIRTUBE EMT, by the way, rates tops on both. But there's no reason why EMT can't *look* good as well!

That's where CIRTUBE EMT "shines," too. Reason for its pleasing polished satin lustre is the cyanide zinc plating process Circle uses (even though it costs a little more to apply than other methods).

The zinc bond is better, too—won't chip or flake off. That's because Circle employs elaborate cleaning processes to make sure that the steel is absolutely clean before plating.

Quality finish is only one of many reasons why CIRTUBE EMT has gained such wide acceptance in so short a time. Why not try it next time you order—you'll like it.

*Trade Mark

C W C **CIRCLE** WIRE & CABLE *a subsidiary of* CERRO DE PASCO CORPORATION

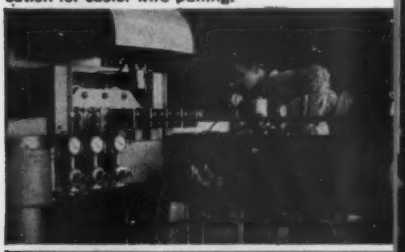
PLANTS: Maspeth and Hicksville, N. Y. SALES OFFICES & WAREHOUSES: In all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*

Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.

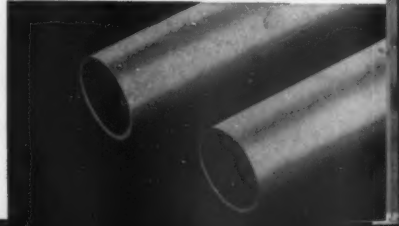


Split-free, bead-free! Induction welded CIRTUBE EMT, left, proves stronger than ordinary EMT, provides easier fishing.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Lifetime exterior finish! Hard galvanized finish for durability; polished satin lustre for lasting good looks.



Get more usable Kva for your distribution transformer dollar with WAGNER®

HI-THERMAL-CAP *TRANSFORMERS*

Every dollar you invest in Wagner® HI-THERMAL-CAP Transformers really buys a dollar and twelve cents worth of usable Kva. For you can safely uprate these High Capability Transformers to 112% of their nameplate Kva without shortening normal life expectancy . . . without exceeding the allowable 65°C hot spot temperature rise.

HI-THERMAL-CAP Transformers have new, compact coils wound LV–HV–LV on one insulating cylinder. Corrugated oil ducts and thermosetting barrier insulation lock the sections into a unit of great mechanical strength. Coils have been subjected to short circuit tests using 50 times normal current (two times as great as the industry standard) without failure.

The HI-THERMAL-CAP element, which combines this improved coil with a wound core of cold-rolled oriented grain steel, has excellent electrical characteristics: low impedance for better voltage regulation; low core and copper loss for economical operation. You get full efficiency plus high capability with new Wagner HI-THERMAL-CAP Transformers.

HI-THERMAL-CAP Transformers, built in single-phase ratings 167 Kva and smaller, 15 KV and below (for direct pole mounting), are now available from factory, branch, and distributor stocks. Your Wagner Sales Engineer has complete information. Consult him, or write us.

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Wagner Electric Corporation

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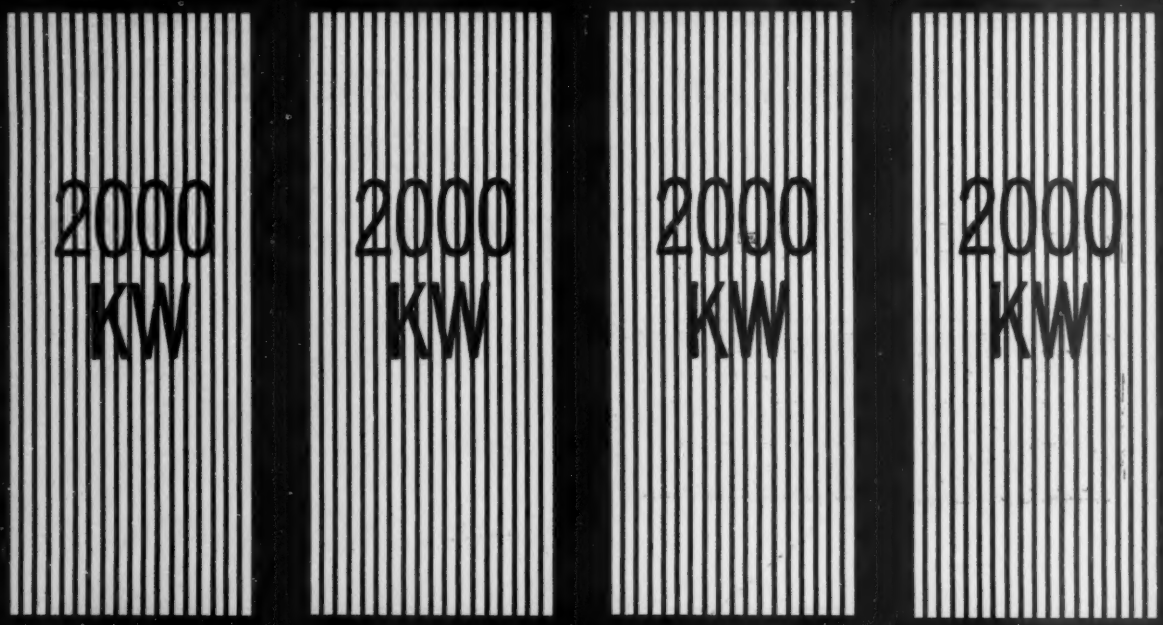


Electro-Motive Peaking Plants

New MU-100 plant $82 per KW, F.O.B. Electro-Motive Factory

For those utilities seeking higher capacity peaking power, the new Electro-Motive 10,000 KW plant offers low investment per KW (as low as $94 per KW installed at site) plus new operating and control features not found on other types of equipment.

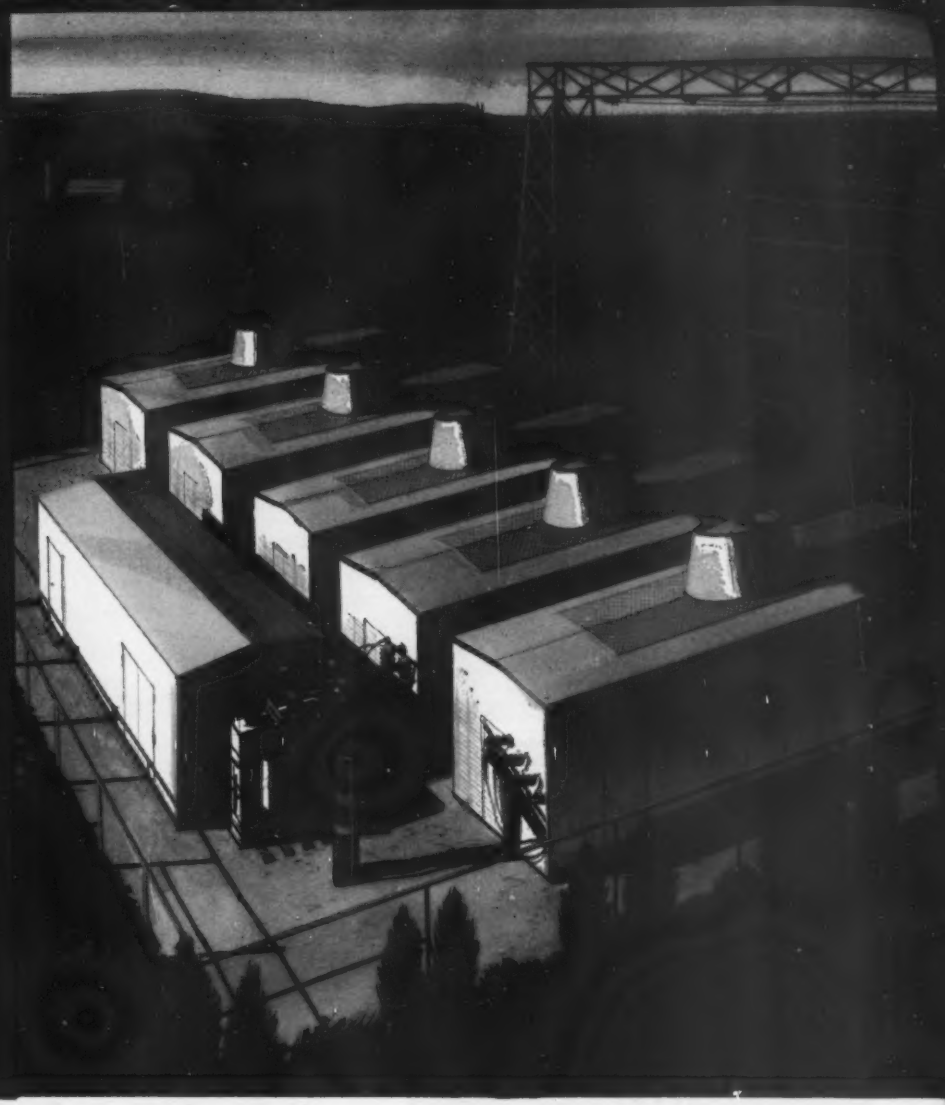
Highly flexible. The MU-100 may be utilized in peaking, reserve or area protection applications. It may be remotely operated by a variety of methods—automatically by voltage or current sensing devices, and by supervisory control such as leased telephone line or by carrier current. Self-contained design permits location at the step-down substation serving the load. Installation is simple and inexpensive, and the plant may be moved at any time to match changing load conditions.

Future expansion flexibility. Smaller Electro-Motive plants (2,000, 4,000, 6,000 and 8,000 KW) can be installed now with control equipment in place to expand later up to 10,000 KW.

By taking advantage of this plan-ahead feature, additional KW capacity can be added later for less than $75/KW *installed*. For example, total end cost for uprating from 2,000 KW to 8,000 KW is the same as the initial cost for an 8,000 KW plant.

New controls. The plant control contains many innovations which further extend flexibility. The plant may be operated remotely at various capacities to match load conditions. Each generator produces 2,000 KW—and each may be operated individually or

NOW + 2000 KW



now available up to 10,000 KW

in any combination. Thus, the plant will provide 2,000, 4,000, 6,000, 8,000 or 10,000 KW. With selective control a block of power is always available—even during maintenance.

Fast start. From a cold start, the MU-100 is on line carrying load in less than three and one-half minutes. A spinning reserve start has been designed into the plant which reduces starting time to a minute and a half.

With the addition of the MU-100 to the Electro-Motive line, the most complete range of capacities is available in specialized peaking equipment. Thus it is possible to match capacity to need for the most efficient operation and lowest investment. An increase in demand is handled by expanding the plant—at low incremental cost—with additional generating components.

An analysis of utility peaking needs will reveal the savings possible with the application of Electro-Motive equipment. Ask the Electro-Motive representative for information.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · LA GRANGE, ILLINOIS

Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario

MU-20 2000 KW Diesel
MU-14DF 1000 KW Dual-fuel

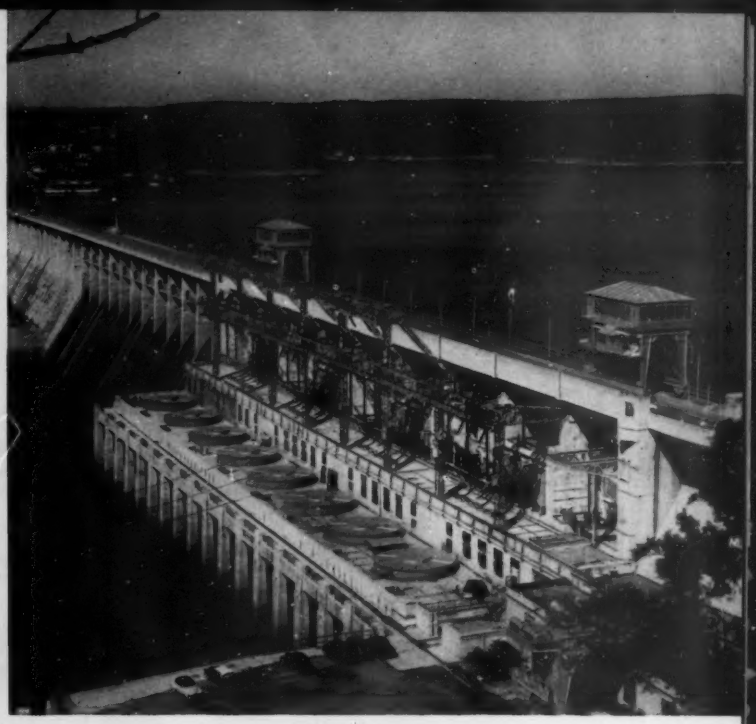
MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel

MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel

MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel

MU-100 10,000 KW Diesel
MU-70DF 5000 KW Dual-fuel

PROMOTIONAL DISPLAY of dusk-to-dawn lighting is demonstrated by District Manager T. C. Brickey at his office, where customers can operate the lamp by covering the Fisher-Pierce control. "Customer" is E. J. Gildehaus of Union Electric Sales Development and Training Division, which provides displays and other promotional material to regional offices.



PHOTOELECTRICALLY CONTROLLED lighting service has proved to be a good off-peak load builder for the system's nearly two-million-kilowatt capacity. Average yearly output of Bagnell Dam, shown here, is 440 million kilowatt-hours. (Photo courtesy Union Electric Co.)

In the St. Louis Area . . .

"Dusk-to-Dawn" Lighting Using Fisher-Pierce Controls Provides Cardinal Improvement In Outdoor Lighting

Homes and businesses throughout the Union Electric Company service area can now have all the advantages of adequate outdoor lighting, automatically controlled by F-P Series 6600A photoelectric controls. Vigorously promoted by Union Electric over the past two years, automatic outdoor lighting has steadily grown in popularity. Several thousand F-P controlled installations are already in use, lighting residential yards and driveways, barnyards, advertising signs, lumber yards and other storage and work areas, gas stations, motels, trailer camps, fruit stands and other roadside businesses.

For the utility, photoelectrically controlled lighting is an excellent off-peak load builder, while the use of reliable controls assures lowest maintenance cost. Utility customers appreciate the convenience of *truly* automatic lighting and the protection it offers — protection from vandalism, burglary and accidents. All indications are that automatically controlled lighting will continue to grow in popularity, for the benefit of all concerned.

For complete design information and specifications on Series 6600A controls, write The Fisher-Pierce Co., 59 Pearl Street, So. Braintree 85, Massachusetts.

FP

FISHER PIERCE

Manufacturers of Electrical and Electronic Equipment for Industry, Utilities and the Home

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

On a job like the Washington Monument...

Seal & Company, Inc. figures costs closely

...but doesn't take chances!

From tip to base, the 555 ft. Washington National Monument glows after dark with a complete new floodlighting system installed by one of the capital's most respected electrical contractors, Seal & Company, Inc. From the transformer vaults, to the four main floodlight clusters, the four pairs of fixed searchlights, the 555 ft. risers—each spliced in 10 pull boxes—and the aircraft warning lights at the top, Seal & Company used—naturally—Burndy connectors. Their cost was only a tiny fraction of the whole job... but they're the vital links that will make the Washington Monument a nighttime landmark for years to come.

"The electrical connectors accounted for only a fraction of 1% of the cost of the Washington Monument job... but everything depends on them. We had too much at stake here to even think of taking chances ...we played it safe by using Burndy."

—Frank Seal, President; Seal & Company, Inc.

Washington National Monument, Seal & Company, Inc., electrical contractor.
Klauckhuhn, Cobb & McDavid Co., Wash., D.C., Engineering Consultants, designers.

BURNDY

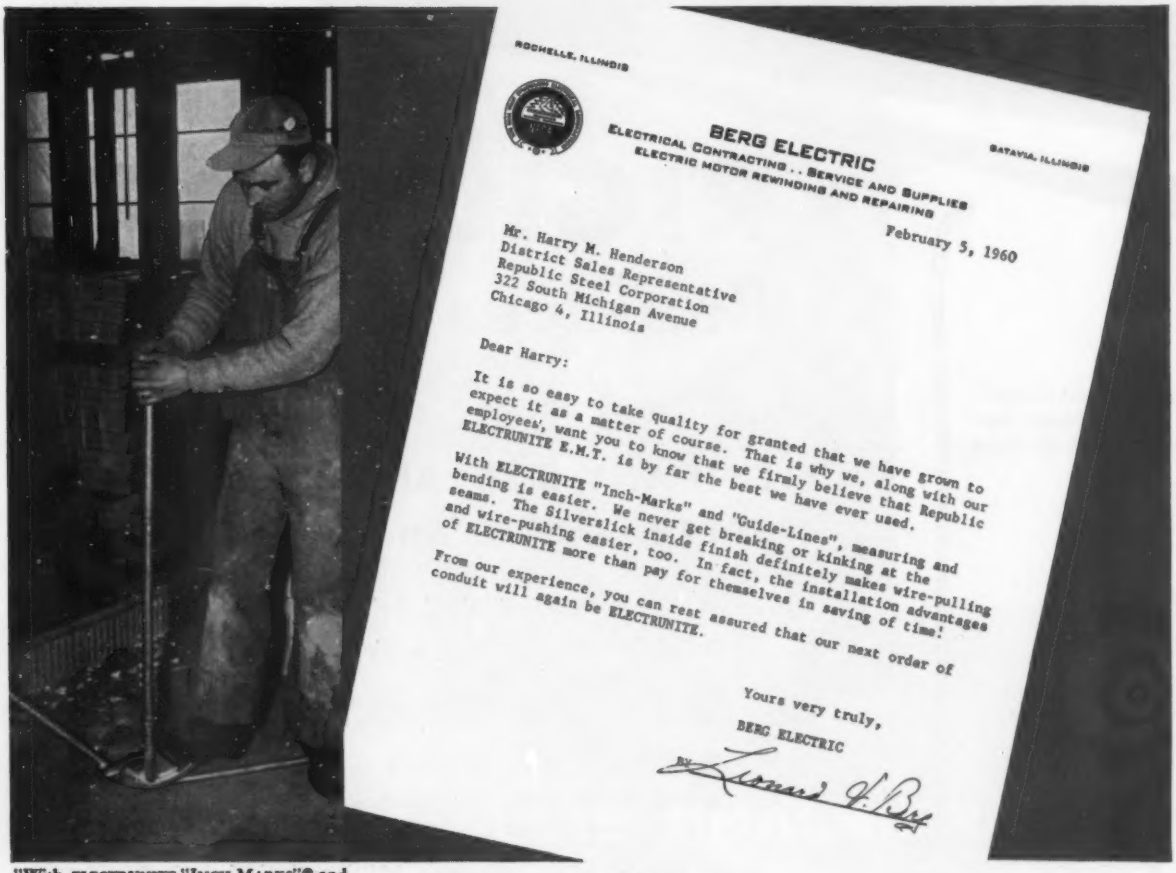
ELECTRICAL CONNECTORS

"More than pays for itself"

Republic ELECTRUNITE Electrical Metallic Tubing because...

THE BEST COSTS LESS INSTALLED

The best testimonial for Republic ELECTRUNITE® Electrical Metallic Tubing is a satisfied user. Leonard V. Berg, Berg Electric, with locations at Batavia, and Rochelle, Illinois, recently completed two major installations using ELECTRUNITE E.M.T. on the job. His letter tells why... The *Best* Costs *Less* Installed!



ROCHELLE, ILLINOIS

BERG ELECTRIC

ELECTRICAL CONTRACTING . . SERVICE AND SUPPLIES
ELECTRIC MOTOR REWINDING AND REPAIRING

BATAVIA, ILLINOIS

February 5, 1960

Mr. Harry M. Henderson
District Sales Representative
Republic Steel Corporation
322 South Michigan Avenue
Chicago 4, Illinois

Dear Harry:

It is so easy to take quality for granted that we have grown to expect it as a matter of course. That is why we, along with our employees, want you to know that we firmly believe that Republic ELECTRUNITE E.M.T. is by far the best we have ever used.

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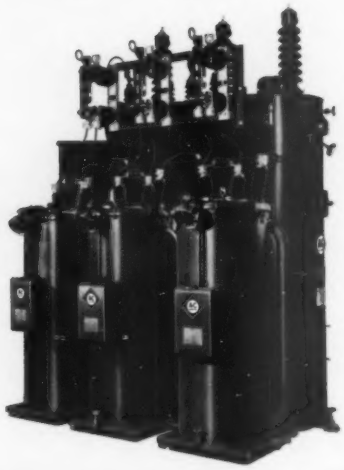

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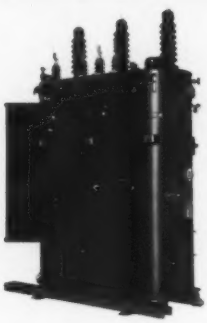
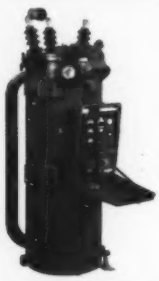


CLEAN, UNCLUTTERED APPEARANCE with sealed-tank construction has no external braces to trap debris, reducing costly cleaning and repainting requirements. Entire line is computer-designed to provide minimum height and weight, quiet operation, ample overload capacity and corona-free performance. All transformer accessories are conveniently grouped to reduce inspection and maintenance time.



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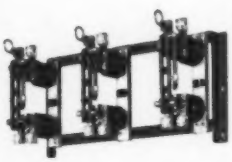

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Developments in apparatus for

By R. B. Pherson

Section Manager
Distribution Transformer Dept.
Westinghouse Electric Corp.

◆ CONVENTIONAL distribution practice in residential areas, using pole-mounted distribution transformers, low-voltage secondary mains, and services, has not changed fundamentally in many years. Economics of installation and operation have favored this practice, and the over-all performance of such systems has, until recent years, been quite satisfactory. Recently, however, certain shortcomings have become evident, and may assume formidable proportions in the future.

Perhaps the most widely discussed problem in present distribution arises from the necessity of transporting energy considerable distances at low voltage. With increased load densities, it is necessary to use large secondary conductors to keep variations and power loss within acceptable bounds, and supplementary means of voltage control are often needed. Even then, it is sometimes impossible to use the full thermal capacity of distribution transformers because of voltage problems.

Conventional systems are vulnerable to damage or outage by virtue of their exposure to lightning, wind, sleet, traffic, birds, and trees. A recent AIEE Committee survey of faults of five-kv systems showed an annual average rate of 16 faults per 100 circuit miles, of which some 74 per cent were definitely attributed to wind, trees, lightning, and other exposure hazards. While this outage frequency may not be considered excessive, the consequences of any outage are becoming increasingly serious, by virtue of public dependence on a continuous supply of electrical energy.

Finally, the increasing pole congestion, due to the presence of transformers, capacitors, protective devices, switchgear, and a multitude of heavy secondary cables, is becoming unsightly, hazardous to linemen, and often requires installation of higher poles when loads increase.

All of these shortcomings of the present system will be aggravated as loads and systems increase in size.

In seeking a solution to some of the problems common to a conventional overhead distribution system, a number of electric utility companies have placed on their systems trial installations, using some form of underground circuits and equipment. Perhaps the most apparent advantage offered by an underground system is the improvement brought about by the removal of conductors, equipment, and supporting structures from sight.

Underground distribution

The underground system will be free from service outages and accompanying expense due to damage caused by lightning, ice, sleet, snow, rain, and windstorms. The probability of trouble caused by motor vehicles, building fires, and foreign objects coming in contact with the system elements is far less than may be expected on overhead systems.

Stated briefly, the advantages of the underground system are greatly reduced secondary voltage drop, improved appearance, greater safety, fewer service interruptions, lower operating and maintenance costs, and longer life.

A major deterrent to the widespread use of underground systems for residential distribution has been the fact that heretofore the cost of vaults or housing for transformers, and of the ducts for cables, have made it uneconomical except in regions of very great load density, or where premium rates could be charged. Other disadvantages are the increase in installed transformer capacity resulting from the reduction in load diversity, the increase in cost per kva of transformers due to the small rating of each unit, and a generally more costly process involved in adding new services.

Many types of transformers and transformer housings have been

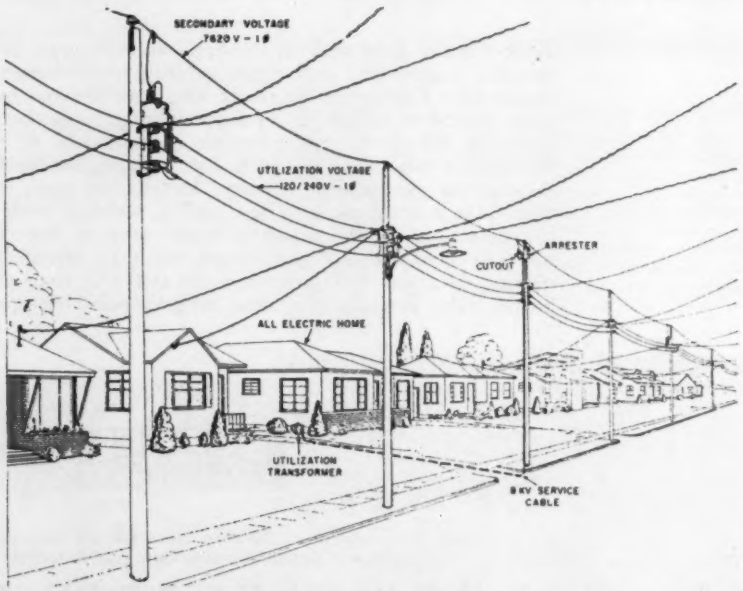


Fig. 1—How the "utilization transformer" can be used for spot installations in existing residential area. Hollow plastic poles would permit high voltage cable to be run down the inside of the pole and then underground to the transformer as shown by dotted line.

underground residential service

used with the underground systems to attempt to find the most economical solution for a given system. Some electric utility companies have used standard pole-type distribution transformers installed in vaults or prefabricated housings, while others have approached the transformer manufacturers for some standardized solution to this portion of the equipment problem.

Buried transformers

Because the distribution transformer formed an important element in many of the proposed underground residential distribution systems, requests were received by Westinghouse as early as 1939 for recommendations. In the interest of holding the cost down, Westinghouse attempted to determine experimentally what would happen if a standard distribution transformer were completely buried in the earth. These tests indicated a reasonable chance that the heat from the transformer losses would keep the surrounding earth sufficiently dry to prevent severe corrosion of the transformer case.

Trial installations were made in 1939, and after load tests covering several months, this scheme was abandoned. Corrosion was quite severe in some cases, depending upon the character of the soil at the installation site. It was further determined that heat transfer properties of the soil varied over such an extreme range, depending upon location, soil character and texture, and rainfall, that the transformers had to be severly derated. This derating might have to be experimentally determined for each general location, or made so large, to allow sufficient transformer cooling under the least advantageous conditions, that the increase in installed kva would make any such scheme quite unattractive.

An alternate arrangement was then proposed, that of providing the transformer with an outer steel shell, with this shell to be only partly buried and the upper portion of the shell to be above ground. This arrangement would lessen the problems of maintenance and derating, and would still be less conspicuous than a surface-mounted transformer. As a result of a joint study between Westinghouse and one of the larger Eastern utilities, the judgment of their engineers was accepted that it would still be questionable practice to bury the steel housing directly in the ground because of the risk of corrosion.

Utilization type transformer referred to in Figures 1 and 2. It is enclosed in low silhouette, rectangular enclosure. Locked metal cover and baffles make it completely "tamper-proof."

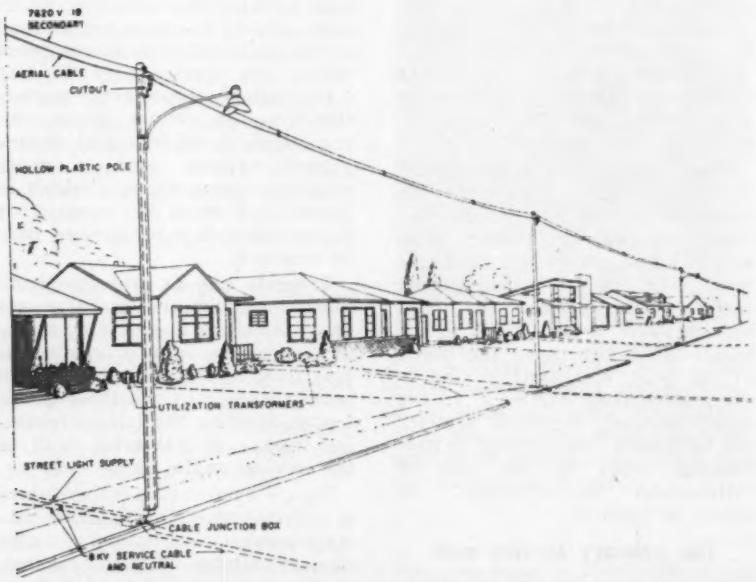


Fig. 2—Overhead systems can be greatly simplified in new residential areas by the use of "utilization transformers." The high voltage service cables would be extended down through poles and underground to the transformers. Street light supply would be obtained from nearby unit.

"Semiburied" transformers

In 1946, Westinghouse introduced a new type of transformer enclosure which overcame the serious limitations attendant upon the direct earth-burial method of transformer installation. This enclosure consisted of a cylindrical concrete pipe for the buried por-

tion, with the superstructure in the form of a steel housing and cover which could be fabricated at the transformer factory. This design came to be known as a "semiburied" transformer installation. Two housing sizes, 36-inch diameter and 48-inch diameter, were made available to electric utility companies.

Standard concrete pipe dimensions were used in the design of the base. The steel housing is of larger diameter than the concrete base, to permit cooling air to be drawn into the enclosure. A section of grill-work near the top allows heated air to escape to the outside. The domed cover is flanged to fit snugly over the steel housing and is provided with fittings by which it may be padlocked to the housing.

An important aspect of any transformer housing which is mounted where it is readily accessible to the public is the degree to which it can be made completely safe and completely tamper-proof. Special safety measures must be designed into any such installations.

The housing case for the semiburied transformer installation is fitted with a baffle ring welded to the inside, behind the open grill-work, to prevent the entry of wires, rods, or sticks which might otherwise come in contact with live parts. The housing support ring at the bottom of the housing serves a similar purpose, preventing entry of objects between the case and concrete base. When the enclosed transformer is properly installed and grounded to the steel housing, there is no external danger present with this type of installation.

Since the introduction of the semiburied transformer installation, a considerable number have been purchased and installed widely throughout the United States, the Virgin Islands, Hawaii, Alaska, and Puerto Rico. The operating experience has been entirely satisfactory.

The utilization transformer

It is generally accepted that, as residential loads increase, overhead secondaries are becoming shorter and transformers are becoming larger and more numerous. By projecting this trend into the future, the conclusion may be reached that eventually most new homes may be served from individual transformers mounted adjacent to those homes.

This concept may be applied to new construction with little change in the existing distribution system, by employing underground radial feeders, and surface-mounted distribution transformers at each residence. Applicable to either an existing underground or overhead system, for practical purposes, this scheme presents a service supply of unlimited capacity as viewed from the "utilization transformer" at the residence.

The "utilization transformer" itself is quite simple in construction, differing from a pole-mounted transformer only in shape and in the fact that all live parts are enclosed in a grounded structure. A locked, metal housing covers the H.V. and L.V. bushings, and is constructed so as to be completely "tamper-proof" from the outside. This is accomplished by suitable baffles inside the housing itself.

Rather than the conventional round tank, the transformer core and coil assembly is enclosed in a rectangular tank designed for low silhouette in order that it be as inconspicuous as possible when mounted adjacent to a residence. A surface mounting of this type precludes the necessity for an expensive underground vault and aids in the transfer of heat from the transformer.

The H. V. protection for this type of distribution system is generally provided by having over-current and lightning protective devices mounted at the point where the H.V. service cable is tapped to the H.V. feeder. The L.V. protection may depend upon a secondary breaker within the "utilization transformer," or it may depend upon the user's entrance fuse or breaker alone.

The "utilization transformer" can readily be used to supply an occasional "all electric" home located an an established area served by an overhead radial system. The use of hollow plastic poles would permit the H.V. service cable to be tapped to the aerial cable, run down the inside of the pole, and underground to the transformer, Figure 1. In the same manner, overhead systems can be greatly "cleaned up" in new housing areas by the use of "Utilization Transformers," as shown in Figure 2.

The primary service unit

Since underground, high-voltage services can solve some of the electric utility company's problems, and since connecting underground services to overhead primaries presents some new problems, the use of a buried primary system has been proposed for some areas.

This type of system has generally developed using a three-phase feeder with a grounded neutral, with single-phase, looped laterals. A grounded neutral system is generally desirable to provide safety and simplicity in metering and switching, and to permit maximum grading of the insulation of the distribution transformers.

The schematic diagram of such a system is shown in Figure 3. It should be noted that sectionalizing of the looped lateral is provided by a switch in each transformer enclosure. The fact that the enclosure includes not only a distribution transformer but also high-voltage disconnects, possible lightning arresters, and other switching or protective devices, gives rise to the term "primary service unit."

By use of the high-voltage disconnect, any service and the associated section of lateral may be de-energized for maintenance, repair or test, without interruption to other services. Further, in the event of failure of a lateral, the fault can be located quickly, since test points are available at each service unit, and the faulty section isolated by means of the adjacent switches.

Service may then be restored to all homes except the one associated with the faulty section, which may also be re-energized as soon as the faulty cable is disconnected within the service unit. This is a particularly important feature in this type of system, since corresponding faults in radial underground systems tend to cause extensive outages, are difficult to locate, and must be repaired or by-passed before all service may be restored.

Laterals may be protected from faults in distribution transformers or on the user's premises by a fuse in each service unit. An additional fuse may be desirable in the two units adjacent to the three-phase feeder, limiting the outage resulting from a lateral cable fault to the services on the faulty loop.

Figure 4 indicates a looped lateral distribution system utilizing primary service units having two disconnect switches. With this scheme, in the event of a lateral failure, service can be restored to all residences once the faulty section is isolated by means of adjacent switches, and no transformer

capacity is lost to the system.

Typical of the several types of primary service units available is a 50-kva, 12,470 grd. Y/7200 H.V. to 120/240 L. V. It is of "CSP" construction, with two internal isolating switches and a dummy H. V. bushing position to provide a visible open circuit. Since these isolating switches will not break load currents at full line-to-ground voltage, primary load-break disconnects at the points where the loop is tapped to the H.V. feeder should be used to de-energize the loop, and faulted sections then isolated by means of the unit switches.

A new concept

Custom-designed transformers and transformer housings for underground distribution in the past have proven to be quite expensive, both for the utility and for the transformer manufacturers. For a manufacturer's costs for this apparatus to be competitive with his costs for standard pole-mounted distribution transformers, he must establish a standardized type of construction and tool up for this type of construction just as completely as he is now tooled for pole-mounted transformers. This has not generally been the case, since there are such widely varying solutions to the problem of transformer equipment for underground distribution.

Westinghouse is now proposing to market a transformer housing which will provide a new concept in equipment for underground distribution. This housing may be described as "universal," since by adding standard pole-type distribution transformers and the desired accessories, it can be used with any one of the underground distribution schemes that have been proposed or that are in use today.

This housing, shown from the outside in Figure 5, will accommodate standard pole-type distribution transformers rated through 25 kva. With a 7-inch extension that is easily attached to the bottom of the housing, this range can be extended to 50 kva, thus providing considerable margin for load growth.

The housing is provided with a draw-out type door at either end, to provide selected access to either the H.V. side of the transformer or to the L.V. side. Both doors contain screened and baffled louvers, giving sufficient air circulation to make unnecessary any derating of the transformers. The edges of the doors are also baffled, as is the remainder of the housing, to provide "completely tamper-proof" construction.

Both H.V. and L.V. transformer connections can be made in the open, without hindrance from any part of the housing. The weight of the housing is such that it can easily be lifted by two men, and

(Continued on page 143)

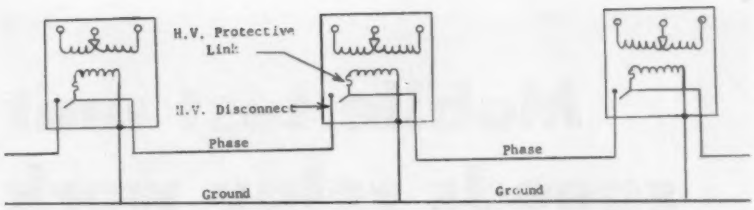


Fig. 3—An all-buried underground distribution system for residential service utilizing "primary service units," including high voltage disconnects, possible lightning arrester, and other protective devices, could be connected, as shown in this schematic, with looped laterals.

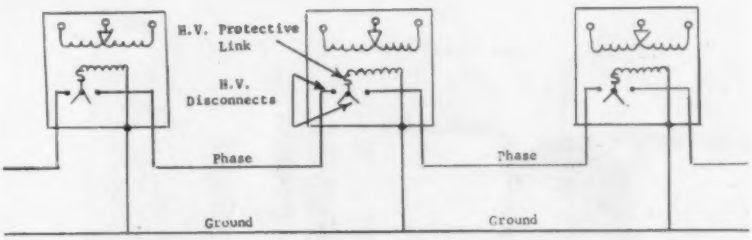


Fig. 4—A system similar to Fig. 3, except that double high voltage disconnects are used. With this scheme a fault in a lateral cable can be isolated and all service restored without loss of capacity.

Fig. 5—This housing, with front cover removed, will accommodate a standard pole-type transformer of 25 kva capacity. With 7-inch extension to bottom, this range can be extended to 50 kva.

Fig. 6—The same type housing used for the transformers can be used for mounting a single-pole oil switch. This one has a knife blade attachment to give visual indication of an open disconnect.

Mobile test unit speeds relay work

This mobile test unit designed and equipped by the transmission department of Southwestern Electric Power Co., Shreveport, La., offers many advantages including clean, comfortable work conditions, minimum of preparatory connections for wide range of tests, and the ability to test relays while in "warm" (recently energized) condition.

◆ TESTING OF RELAYS in transmission substations has been speeded up and made a much more efficient operation for Southwestern Electric Power Co., Shreveport, La., through the use of a mobile relay testing laboratory developed by personnel of the company's transmission department.

No longer will relay testing be subject to weather conditions, and no longer will it be necessary for system electricians to spend as much as two hours time a day assembling and disassembling equipment needed to make these tests.

Testing equipment for all types of relays used in Southwestern's transmission substations has been installed in a Step-Van truck fitted out for this purpose. A year-round electric heat pump has been installed in the truck to provide year-round comfort for system electricians making the tests. A control board is designed so that it can be connected to conduct tests on every type relay used in the stations.

Before this truck was devised, transmission men used a panel truck in which they carried all their testing equipment. Upon arrival at a substation, they had to unload the test gear needed for a specific type relay, and then assemble it for the actual testing. When more than one type relay had to be tested, the men had to reconnect the entire test equipment, which occasioned even more time loss.

In substations where there were no control houses, testing had to be postponed when it was raining or even when it looked like rain, since they could not take a chance on getting relays and test equipment wet. To compound their problems even more, the men were always faced with the threat of dust blowing into the relays while testing them out of doors. All in all, it was not a suitable arrangement for testing.

Problem recognized

Supervisor of Transmission Johnny Boyd reports that this problem had been recognized for some time and that much thought had been given to finding a solution. He said some utilities had central testing laboratories where all relays were shipped for testing. This did not seem to be the best solution because it would take

time to ship the relays, and it also was possible that they might be jarred in transit, damaging bearings and gears. The relays could also accumulate dust and might be in worse condition when they arrived at the substation than they were in the beginning.

The idea for the mobile testing lab developed over a long period of time but Mr. Boyd said Electrical Engineer Leary Wright and System Electrician Harold Richard are due much of the credit since they drew the design for the mobile lab. Mr. Richard and his apprentice, Leroy VanDyke, wired in all of the equipment after utility cabinets were built for the Step-Van truck.

Now complete and in service, the relay test unit wheels into a substation where the operators connect it to a 220-volt power supply at the station, turn on the year-round heat pump, and start to work.

They remove the cover from the relay to be tested, pull the relay out (98 per cent of relays in the stations are of the draw-out type) and insert it in a test case inside the truck. Sides of this test case are open so that system electricians can make their inspection and adjustments without removing the relay from the test case.

"Warm" testing best

Manufacturers all agree it is best to test relays while they are still "warm," and they recommend that relays be energized for at least 30 minutes prior to testing. With this mobile laboratory, relays are pulled right out of operation, tested in a minimum of time, and thus are still warm from being in operation.

The year-round heat pump is proving a great help in speeding up testing, also. The men aren't perspiring and their hands aren't damp, so that they can work better. In the winter, their hands won't be numb from the cold.

Mr. Boyd also reports that the operators are making their tests faster than before even though they are having to get accustomed to the equipment. It is necessary, of course, to check blue prints now to determine which leads are to be plugged in to test different types of relays. Once they learn the panel board, work will be speeded up even more.

One side of the mobile test unit provides compartments for storing test equipment, leads, records, etc. In the center of this side of the truck body is a year-round heat pump for operators' comfort.

The other side of the truck body includes the work space shown on the preceding page and the test equipment and cross-connecting board shown above. The arrangement of switches and plugs permits testing any type relay on the system with a minimum of preparatory setup.

Grounding for substations

First of two articles on principles and practices

By C. H. Jensen

Chief Electrical Engineer
Copperweld Steel Company
Glassport, Pa.

◆ GROUNDING serves an important function in all phases of modern electric power system operation. Grounds are used at generating plants and substations, on transmission and distribution lines, and on the facilities which supply the users of electricity. From the initial production of the electrical power to its ultimate consumption, grounding aids in improving operation and continuity of service and in increasing safety for life and property.

In considering the uses of grounding at substations, it should be remembered that the term substation is applicable to a great variety of electric stations. There are transmission step-up, step-down, and switching stations; distribution substations serving commerical and residential power and lighting loads; and industrial substations of various types and sizes. Basically, the grounding principles are similar for all, but because of variations in service and operating requirements it is not possible to cover the different types in the space allowed. This discussion covers some of the general practices and methods applicable for grounding outdoor substations from which overhead transmission and distribution lines radiate.

In the operation of such stations, grounding is of particular importance when it is considered that they are usually places of considerable concentration of power and load centers upon which continuity of service is dependent. Large and expensive equipment may be located at such sites and frequent operation and maintenance work is done by employees. In the case of attended stations, the element of safety to personnel is of still greater importance. Because of these various factors, it is essential that careful consideration be given to the design and installation of the grounding system so that it will fulfill the purposes for which it is intended.

Purposes of grounding

The purposes of substation grounding may be summarized briefly as follows:

(1) Grounding for lightning and surge protection.

(2) System grounding to stabilize circuit potentials with respect to ground and to provide a means of circuit relaying to clear ground faults.

(3) Grounding of non-current carrying structures and parts and auxiliary low voltage circuits for safety to personnel.

Grounding may be employed for one or more of the foregoing purposes at a particular substation. At one time it was the usual practice to install separate grounding facilities for each purpose. For example, the lightning protective equipment had its own ground or set of grounds and the main system ground was connected to another set and so on. It is evident that this involved considerable expense to provide all these separate connections. Later, it was found that interconnecting the different grounds aided in securing greater effectiveness as the conductance of each ground supplemented that of the others in the group. In modern substation design and construction it is, therefore, a common practice to use a single all-purpose ground.

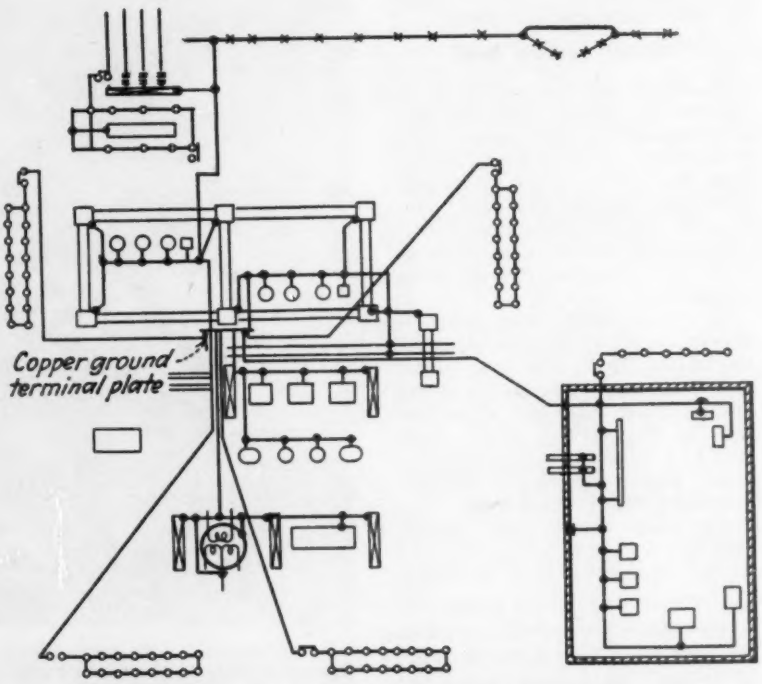


Fig. 1—Radial grounding system featuring four groups of rods or ground beds located at the periphery of the area occupied by equipment.

The principle requirements for a substation ground are low resistance and adequate current carrying capacity. For lightning and surge protection, low resistance is important so that the high current, high frequency disturbances, which are usually of very short duration, will pass quickly to earth. Otherwise, high potentials may build up on lines or equipment with possible flashovers or breakdown of insulation.

In the case of low frequency faults or short-circuits, adequate current carrying capacity in addition to low resistance is essential. The ground system may, at times, carry very heavy current and it must be capable of handling and discharging them into the earth without damage to equipment or hazard to personnel. These features are also essential for relaying purposes so that the protective equipment will operate quickly to clear the faults.

For safety to personnel, uniform or near-uniform ground potential should be maintained on all structural steel work and parts of apparatus and equipment other than those which are energized. Furthermore, by providing uniform potential over the entire substation working area, any differences in potential that may exist over a short distance during faults or other disturbances will not create a hazard to attendants.

Types of substation grounds

There are three general classes of substation grounding systems that have been employed, namely, radial, bus or ring, and grid. Combinations of the three types have been employed in some instances. A type of radial grounding system is illustrated in Figure 1. The four groups of rods or ground beds are shown as located at the edge or periphery of the area occupied by the equipment and the leads to these beds are rather long. There are also two other smaller ground beds, one for the lightning arresters and another just outside the building which houses the switchboard and control equipment.

With the ground beds located some distance away from the common ground terminal plate or bus as shown in this illustration, the length of the ground connecting leads and consequently the path between any group of structures and earth electrodes may become excessively long. The high impedance of such long leads may interfere with quick passage of fault currents to earth. Should a fault develop in any one lead, the group of equipment or structures connected thereto would be isolated from the rest of the grounding system with the attendant possibility of dangerous potential gradients.

The radial type ground is useful in some cases where adverse soil conditions may be encountered. Rock strata underlying a relatively thin layer of soil may prevent driving ground rods to any appreciable depth. In some instances, it has been found that the topography changed a short distance away and better soil conditions were available. By installing a ground bed at such locations and connecting it to the main substation ground bus with a heavy cable, the reliability of the grounding system can be greatly improved.

The bus or ring system which is illustrated in Figure 2, offers some marked advantages over the radial system. In this system, a loop or ring bus is installed around all, or nearly all of the station equipment or structures. To this bus are connected all the individual structures and equipment ground connections, either radially from the loop or as subloops within the main bus. All ground beds are also attached to this bus.

It is apparent that the length of any connection between structures and bus is relatively short and because of the numerous parallel paths and connections, the effective resistance of the complete ground connection will be less. Where the taps form sub-loops the number of parallel paths to earth is still greater and the resistance is correspondingly further reduced. This multiplicity of paths minimizes the possibility of a failure of the ground connection since the probability that all connections will fail at one time is exceedingly remote.

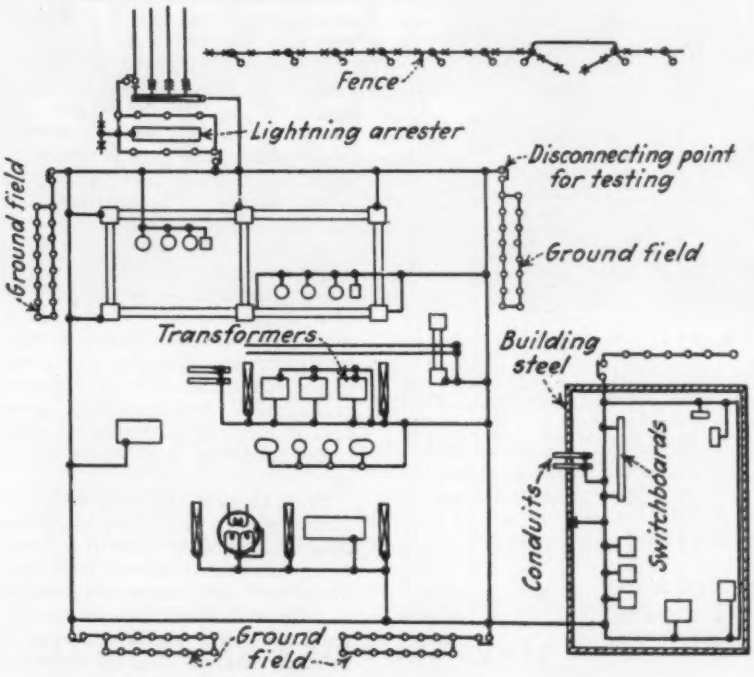


Fig. 2—Bus or ring grounding system with a bus looped around all or nearly all of the equipment. Ground beds attach to ring bus also.

Grid system preferable

The grid or network type of grounding system is illustrated in Figure 3. Since this will be discussed in more detail later, only the general features will be mentioned at this time. The grid or network of cables is installed to cover all or nearly all of the substation plot and rods are usually driven at each intersection of these cables. Equipment and structures are connected to the grid at the nearest point and the number of parallel paths between any such tap connection and the ground

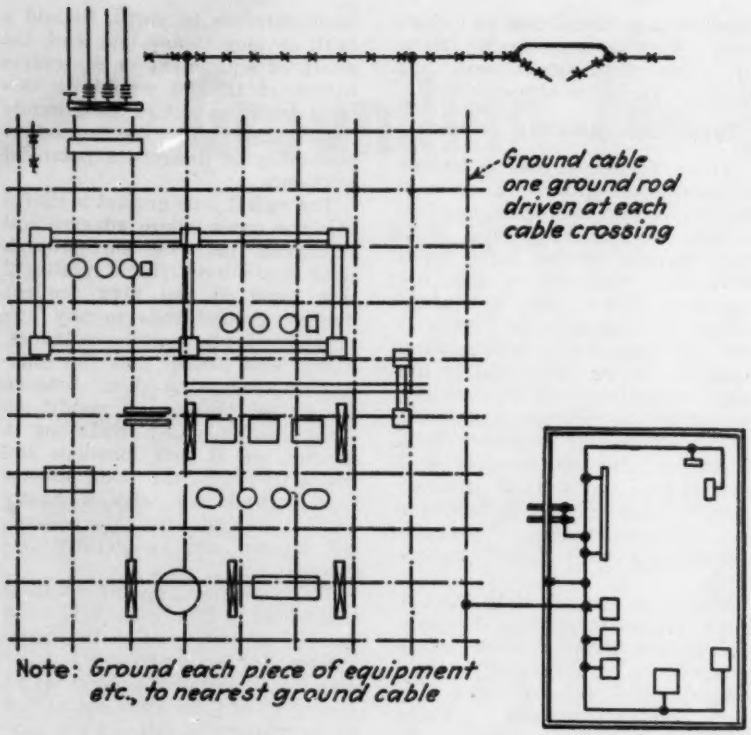

Ground cable one ground rod driven at each cable crossing
Note: Ground each piece of equipment etc., to nearest ground cable

Fig. 3—The grid or network type of grounding system is illustrated here. The grid of cables is designed to cover all or nearly all of the substation plot. Rods are usually driven at cable intersections.

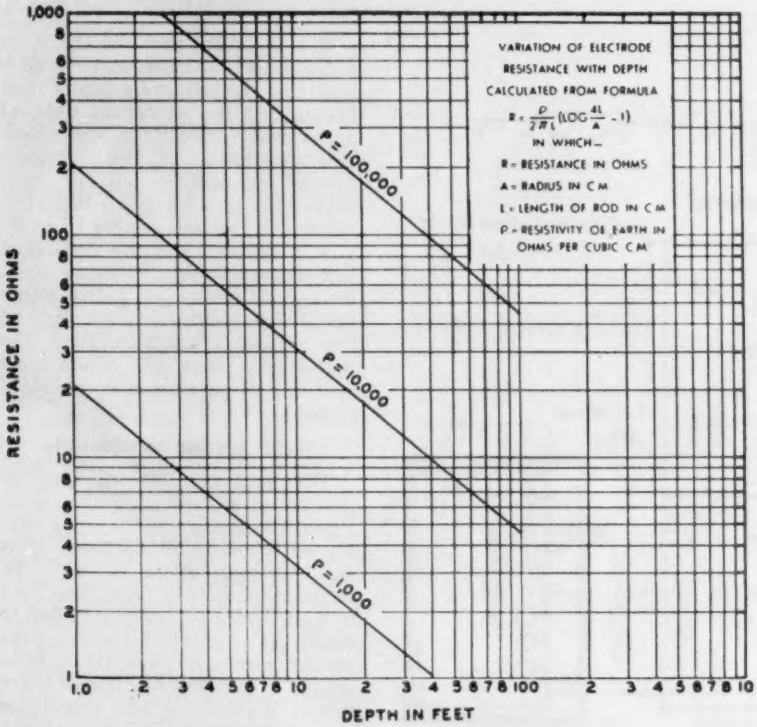


Fig. 4—This chart shows the theoretical curves of resistance for various lengths of rods assuming homogeneous soil of three different values of resistivity. Resistance formula is given in inset.

electrodes results in a path of high conductivity and low resistance.

Considering the three general systems of substation grounding, the grid type is probably to be preferred from the standpoint of efficient grounding and gradient control. However, the radial and bus or ring systems have their particular applications and have been used for many installations. Economically, they are probably less expensive to install than a grid system.

Grounding methods

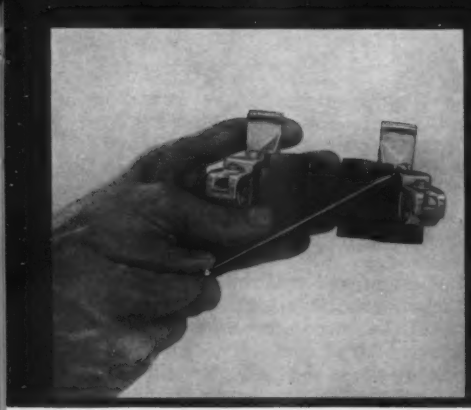
In the illustrations of the three types of grounding systems, it is apparent that a comparatively large number of ground rods connected in multiple are required. Well distributed grounding beds using driven rods probably provide the most efficient use of the money spent for grounding if the rods can be driven to effective depths without encountering rock or other obstructions.

Practical methods and procedures for securing satisfactory grounds have been covered in various papers and articles published in electrical magazines, trade papers, and manufacturers bulletins. However, much of this information is of a rather general nature and does not cover the practical aspects applicable to the design, installation, and testing of substation grounding systems.

For large modern substation sites covering extensive areas and with the equipment extending over a considerable portion of the property, to be effective the station grounding system should cover this same area. It may, therefore, consist of a relatively large number of electrodes connected in multiple. Because of this, the design problem is somewhat different and more complex than when a ground connection consists of a single rod or several rods in multiple. For such large ground fields, consideration must be given to the maximum ground currents, ground area, soil resistivity, number of electrodes, length of electrodes, spacing, paralleling effect, etc.

In analyzing the resistance requirements for a substation ground field, information as to the maximum ground currents that may occur at the station is essential as this will determine the resistance necessary to limit potentials to safe values. In this determination, a study of the characteristics of all of the equipment

(Continued on page 144)



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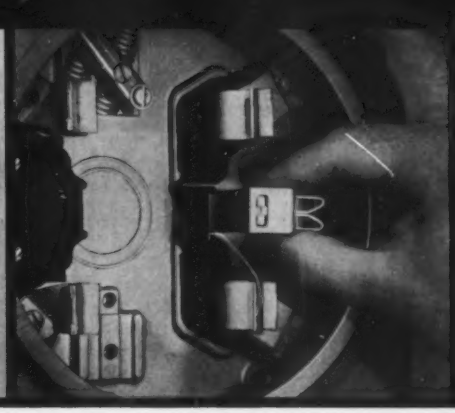

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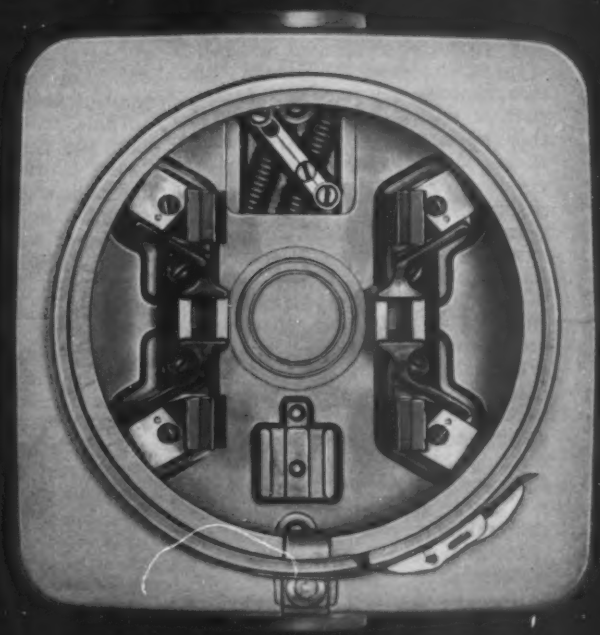

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METER DEPARTMENT

GENERAL ELECTRIC

Methods of controlling flicker

By L. R. Gardner*
and W. T. Kittinger*
Houston, Texas

◆ ONE OF THE MORE aggravating aspects of providing good service and maintaining good will is voltage fluctuation known as flicker. The term flicker has gained popular usage because of the accompanying visual perturbations on lighting systems. Prime sources of flicker are system transients and utilization equipment.

At one extreme is the one shot fluctuation so severe as to cause loss of control equipment and subsequent shutdown. Although this is a problem of considerable import, it will not be considered in this paper. The more common flicker complaints arise from its effect on lighting systems and sensitive electronic equipment.

In view of the stiff distribution systems which have been engineered since World War II, legitimate lamp flicker complaints should be relatively few and reasonably well localized. Utilities are reminded of the flicker suppressing qualities of their system only in a negative way, through complaints. There is never any indication of how many observers are subjected to the same stimuli yet are unannoyed to the point of complaining.

In regard to customer complaints, some rather peculiar results were obtained in an informal study made by a large utility. It was indicated that a great percentage of the complaining customers were not aware of the actual nature of their voltage trouble. Complaints of high voltage, when investigated (24 hour charts), proved to be low voltage and vice versa. Some of the charts showed flicker which should have been objectionable by most of the published curves yet the complaint was not of flicker. Complaints of low voltage proved to be flicker troubles, etc.

Flicker is a problem only when someone is annoyed by it. How then should a set of flicker rules be developed? Many utilities have no flicker rules. Many are using the results of one of the many published studies, of which perhaps the most familiar is the set of composite curves of flicker studies in the General Electric Distribution Data Book.

Flicker rules

Several utilities have had excellent success in formulating their own rules based on careful investigation of complaints. Because of the subjective nature of "borderlines of irritation" it is doubtful that an industry-wide standard will ever evolve. The goal of such a standard should be to hold complaints to a minimum, and yet be achieved within economic limits. These economic limits will also vary from company to company.

Regardless of the standards set by a utility, flicker problems will still arise. These should be relatively few and should be reasonably well localized. Utilization equipment involved will vary from fractional horsepower motors to that requiring several thousand kva.

Each case will require individual study and prescription. In some instances, remedial action will be the responsibility of the utility; in others, it will be the responsibility of the customer. Many methods of reducing flicker are available, some of which will be discussed here.

Isolation of flicker-producing load. Perhaps the most elegant methods of reducing flicker are also the most drastic. If a single flicker-producing load produces sufficiently severe problems on primary and secondary distribution lines, it could conceivably be served with its own feeder from the substation. This may create other problems if the utility concerned has a single service rule.

Another most elegant, but costly and inefficient, method is to interpose an M-G set between supply and load. The inertia of the rotors (extra inertia can be supplied by a flywheel on the M-G set) will supply energy during load perturbations and will smooth out the flicker on the supply side. This could be used on motor loads which vary cyclically, such as compressors and pumps, and on intermittent heavy overloads such as are common to sawmills and rock cutters.

Voltage regulators. Voltage regulators vary from line type regulators serving relatively large loads, to voltage stabilizers supplying low kva requirements, and electronic regulators serving control circuits and electronic equipment. Step or induction type regulators operate only after a time lag and are unsuitable for correcting flicker. Single-phase voltage stabilizers with capacities up to about 10 kva are available. These, in addition to giving a steady state output voltage stabilized to within ±1%, also serve to filter flicker from the supply to load or vice versa. Electronic regulators are effective in maintaining a relatively constant output voltage, but are limited as to current capacity. They are particularly useful where sensitive electronic equipment is involved.

Inertia. The installation of a large mass of inertia (flywheel) will help smooth out bumps on motors with pulsating and intermittent loads. This will not reduce the magnitude of flicker on starting and will prolong the recovery time.

Capacitors. Shunt capacitors, although extremely useful for improving regulation on static loads, provide no benefit for minimizing flicker, and may in some instances aggravate it. Shunt capacitors must be switched with load to minimize voltage drop. Initial motor inrush current could be neutralized with shunt capacitors but they would have to be adjusted during the starting period to reduce flicker. This is highly impractical.

Series capacitors as flicker reducing agents are becoming increasingly popular. By neutralizing the inductive reactance of the system, the line impedance can be reduced to just the resistive component. This reduces line drop for static loads and transient loads.

*Mr. Gardner is associated with Houston Lighting and Power Co.; Mr. Kittinger is a professor at University of Houston.

Series capacitors must be protected with a bypass device in the event that abnormally high voltages develop. There have been instances in which shunt capacitors providing power factor correction to a large motor have been switched to the series connection on starting in order to hold up the starting voltage and reduce flicker.

Reduced voltage starting equipment. Reduced voltage starting equipment is a practical method for reducing motor starting flicker. These starters represent a sizable investment to the user and should be recommended only after careful investigation of the starting characteristics of the motor and its load. Reduced voltage reduces torque by the square of the voltage. If the difference in torque produced by the motor and that demanded by the load is low, acceleration is impeded and excessive currents may flow for long intervals. Although these starters decrease the magnitude of flicker, the frequency of flicker will be increased if the starter has several steps.

Decrease the circuit impedance. Perhaps the most practical method of reducing flicker is to decrease system impedance. The voltage drop caused by a given current supplied through a network is inversely related to the steady state short circuit current that would flow at that point during fault.

The short circuit current is determined by network impedance. Factors affecting network impedance are transmission lines, substation and distribution transformers, primary and secondary distribution lines, series reactors, series capacitors, customer wiring and load. Any change in system impedance will effect a change in short circuit capacity and thus a change in flicker.

Changes in individual elements should be considered with respect to the whole. Reducing the impedance of a distribution transformer 50% may affect the overall short circuit impedance by only a few per cent. Increasing conductor size for a fixed spacing does very little to change reactance which is the predominant impedance element on widely spaced aerial lines.

Distribution primary rearrangements sometimes alleviate voltage dip problems at a relatively low cost compared to other circuit improvements and may also benefit

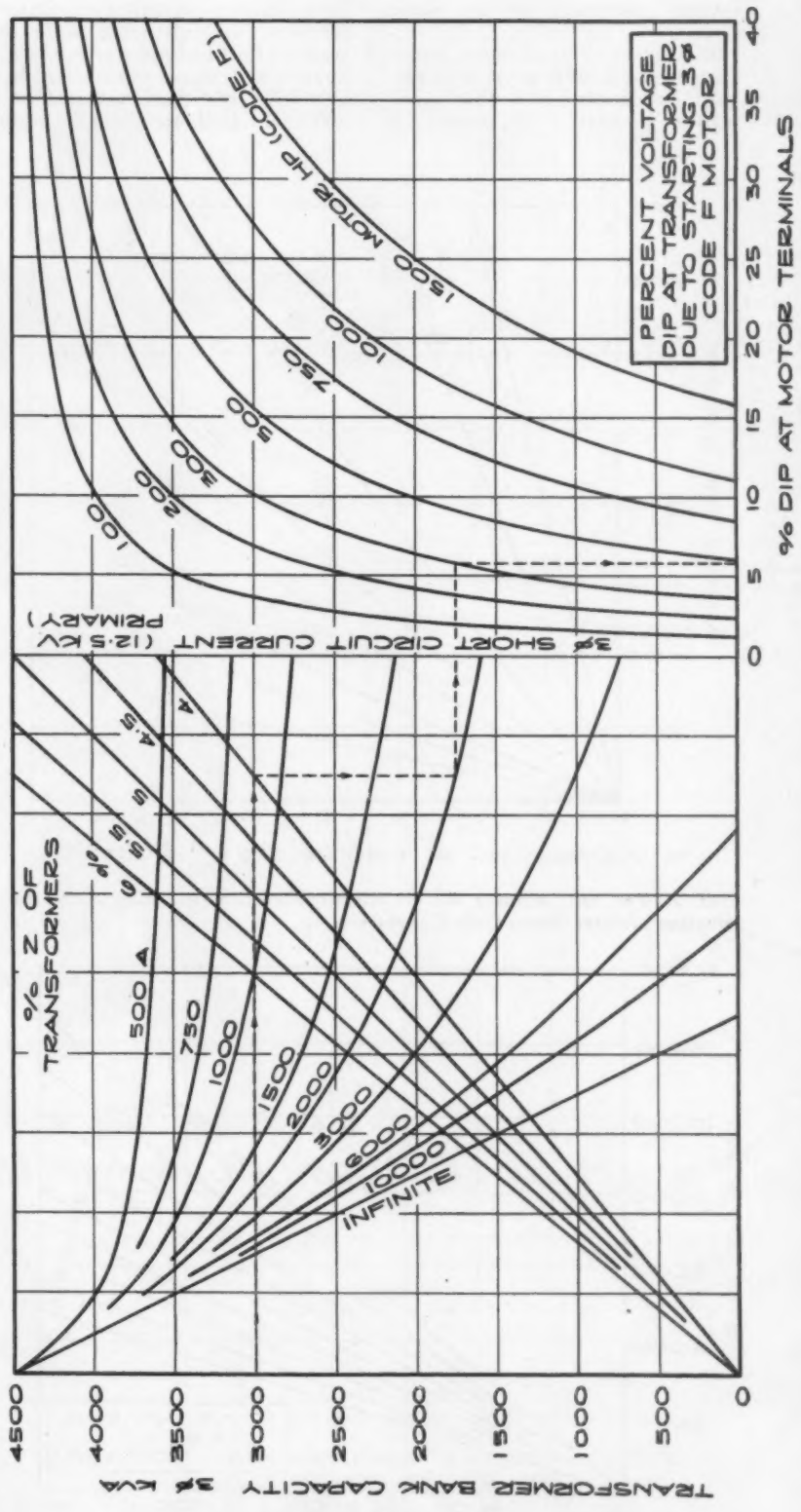

Fig. 1—This family of curves permits the determination of per cent voltage dip at transformer resulting from the starting of three-phase Code F motors. The dotted line shows solution of a typical problem.

several customers on the same line.

Distribution transformers represent a considerable portion of circuit impedance and thus contribute a sizable component of total flicker. Distribution transformers are most often sized to running load and not starting load. Several advantages are realized by oversizing distribution transformers such as better steady state regulation, lower flicker, and possible elimination of the need of shunt capacitors to improve regulation.

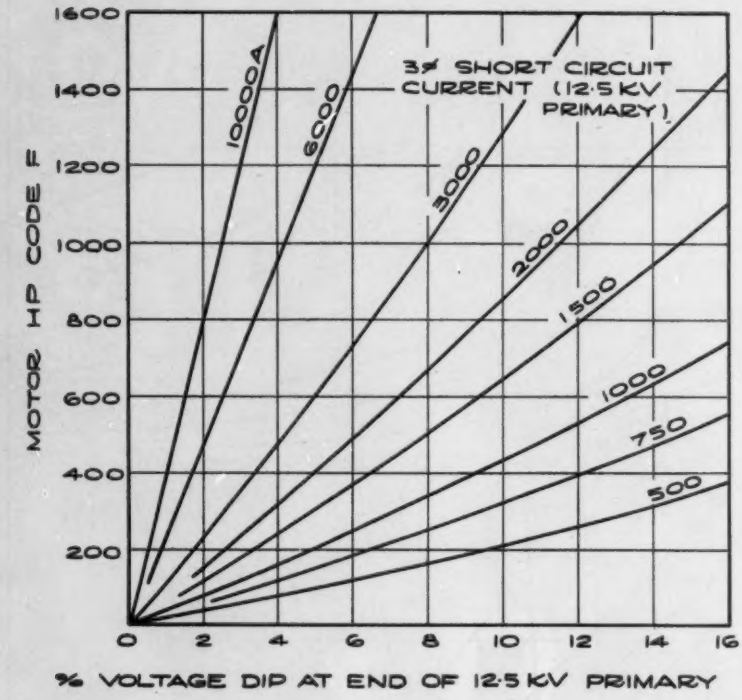

Fig. 2—Per cent voltage dip on distribution line resulting from the starting of three-phase Code F motors.

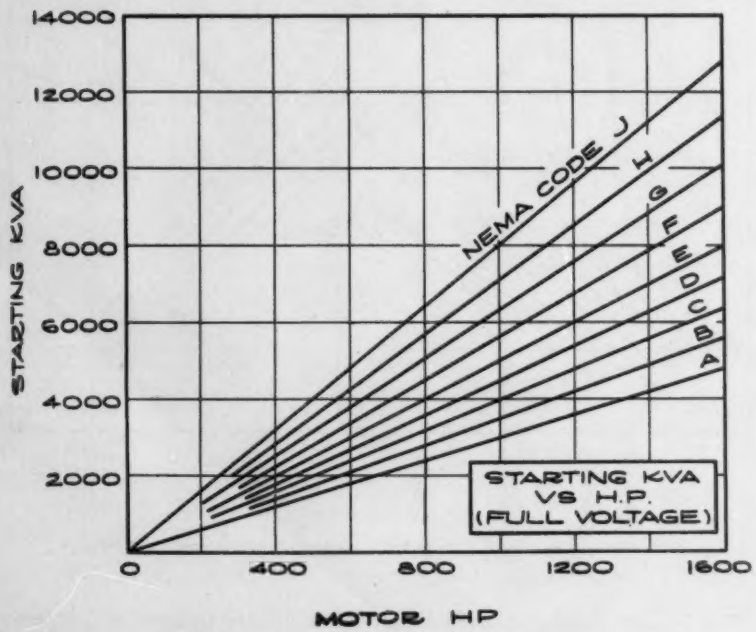

Fig. 3—Motor starting kva versus hp for full voltage starting.

It is often the case that the customer's wiring is the source of many flicker complaints. When the wiring was originally installed it was sized for connected load, but as the load grows the problem of improper wiring grows with it. If the wiring is, according to "code," it should not be of much concern.

Autotransformers. A relatively inexpensive autotransformer can be used to reduce dip caused by 120-volt appliance loads on 240/120-volt single-phase service. The autotransformer (a 240 volt reactor or balance coil with 120 volt tap) is placed at the end of a three-wire single-phase distribution secondary or at some intermediate point. In typical instances this has reduced flicker on a 120-volt circuit by 40% to 60%.

The degree of correction is a function of the impedance of the autotransformer. The necessary capacity of the transformer is a function of the steady state unbalance in 120-volt load taken from the two sides of the neutral. Both of these factors must be considered in sizing the device. The autotransformer should be fused for protection in the event of secondary faults. Investment in a lightning arrestor at the autotransformer may also be justified.

Banked secondaries. A great many utilities are finding their flicker problems reduced as they go to banked secondaries. This effectively increases short circuit capacity on the secondary and thus reduces flicker. Secondary banking provides better service continuity but has other disadvantages which many utilities consider of paramount concern.

Across the line starting. Motors starting across-the-line at full voltage have probably resulted in more flicker problems than any one single factor. Just what limits should be placed upon starting motors has been of great concern to both the utility and the user for some time.

From a recent study, a value of 6% voltage dip at the transformer terminals may be acceptable to the power company if it occurs no more than four times per hour. The customer must decide on how much dip he can tolerate and still have his equipment function properly. The customer must be careful that the voltage remains suf-

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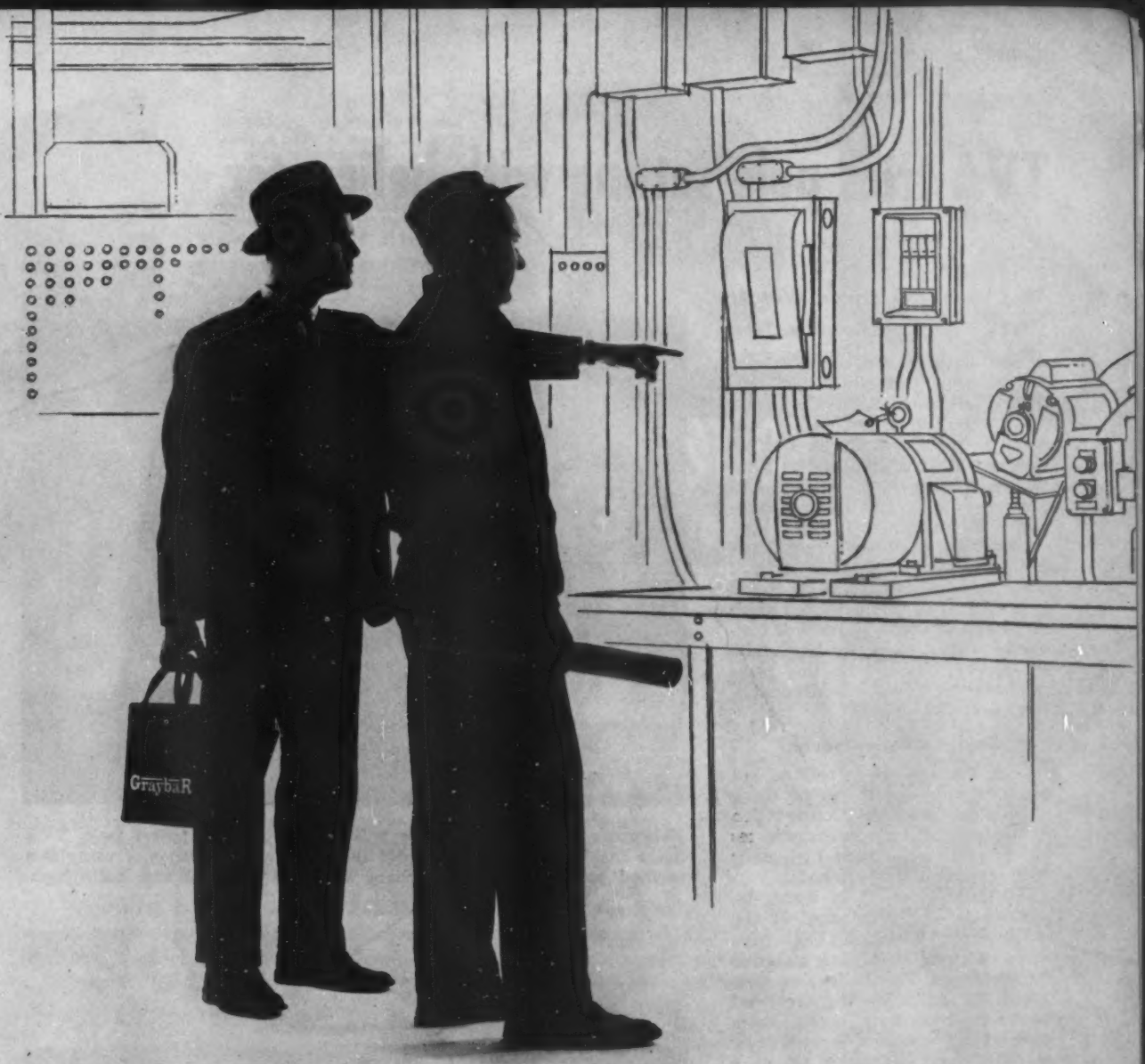

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TVA tries pole setting with helicopter

By Ogden Warner
Knoxville, Tenn.

◆ AN EXPERIMENTAL setting of transmission line poles by helicopter has proved successful, reports the Tennessee Valley Authority. A "preliminary evaluation" reported indications that future helicopters of greater lifting power may cut line construction costs further.

Under contract with Petroleum Helicopters, Inc., Lafayette, La. TVA used a Sikorsky S-58 Model B helicopter to transport and place 69 poles and carry 29 reels of conductor cable over an eight-mile 46,000-volt line construction project near the Tennessee-Mississippi line east of Memphis.

Cost reduction sought

The test was made to find out the possible advantages of using helicopters on line construction where rugged terrain complicates access and causes very high costs with conventional methods.

All poles and reels were deposited at a staging yard at the mid-point of the line. The crossarms and insulators were mounted on the poles. The helicopter then lifted the poles by the free end above the cross-arms, carried them to the point where they were to be installed, and with the aid of a two-man ground crew lowered them into holes dug in advance.

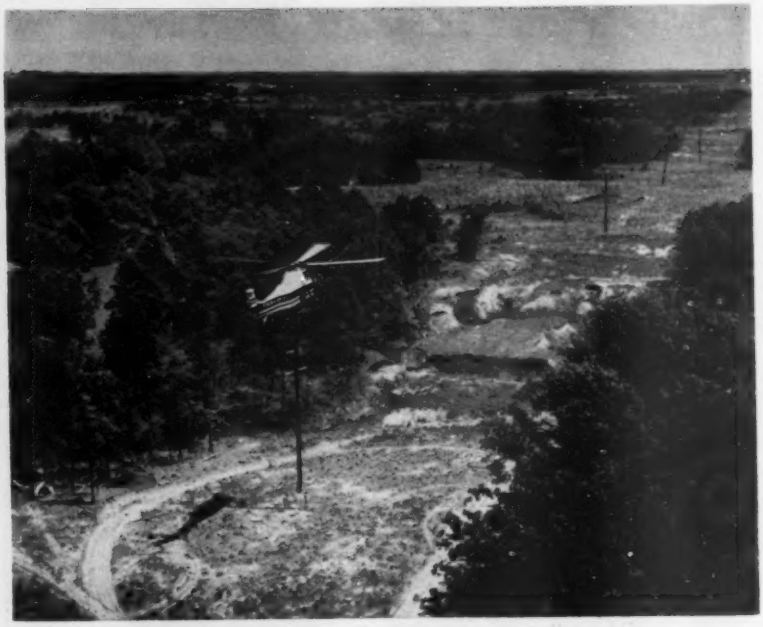
Total flying time for the 98 load trips was 10 hours and 15 minutes.

The average haul was four miles for the round trip from the staging yard and return.

Pole loads to 4,000 lbs.

When the fuel load was low and atmospheric conditions favorable, the helicopter handled some poles weighing as much as 4,000 pounds. In general, however, the load was limited by the rated capacity of the machine, which was 3,750 pounds.

It is believed that a helicopter of greater lifting capacity, which may be available in a year or two, "could be more generally adaptable to transmission line construction and result in lower costs."



Helicopter hovers over a hole with its airlift of a power pole. TVA made the experiment to find out the possible advantages of using this method in rugged terrain where access is difficult and costs high.

This is the staging yard for the airlift of power transmission poles. Crossarms are assembled on poles. Weight of assembled poles in some instances was as high as 4,000 pounds.

¾ HOOK . . . preferred by linemen, makes it easier to engage the eye of the clamp to be removed. Extra-strong bronze ¾ hook seats deep in head casting to prevent twisting open. Note, too, how yellow color assures hi-visibility where it counts most . . . at the "business end" of the stick.

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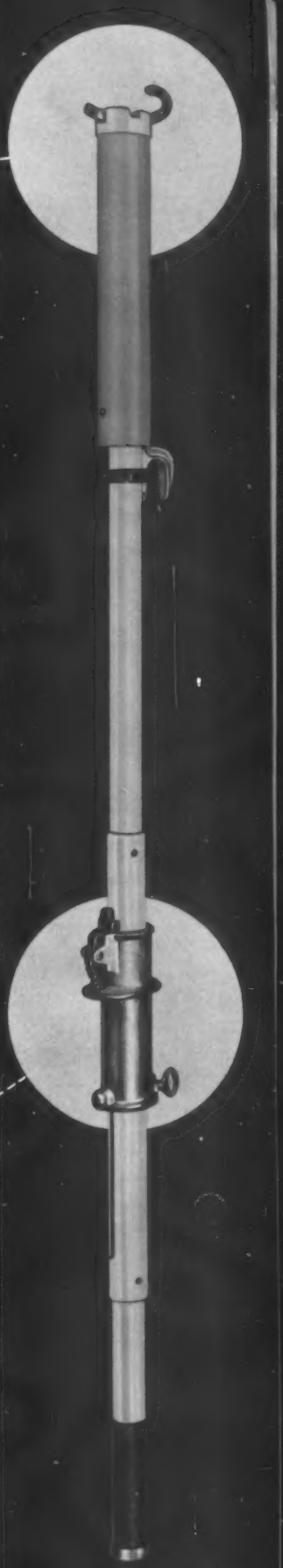

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NEW! **Telltale yellow surface shows instantly if the stick is safety-clean.**

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Kearney's new clampstick combines the lightness, ruggedness and high dielectric strength of a Fiberglas pole with a slick new mechanism . . . plus an important bonus . . . yellow color permanently molded-in for maximum visibility. Needs no costly refinishing.

Operating rod mechanism is fully enclosed, protected . . . prevents rod damage, eliminates rod servicing. Only 3 moving parts . . . nothing to bind, stick, get out of adjustment. Field-strips for fast, easy cleaning by removing only *one* screw. Equipped with ¾ hook . . . thumb latch, safety-lock and stop. Non-slip grip.

Yellow non-porous surface instantly shows soil, grease or dirt which might cause excessive leakage . . . wipes "safety-clean" in seconds.

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Available in 4', 6', 8', 10' and 12' lengths, one-piece or hinged.

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THUMB LATCH . . . conveniently located on aluminum operating handle. Faster, easier to use with gloves. In latched position keeps hooks open while engaging clamp eye . . . prevents accidental retraction of hook. Sharp downward pull of handle releases latch, closes hook. Safety stop prevents accidental opening of hook while clamp is engaged. A locking wing screw is also provided.

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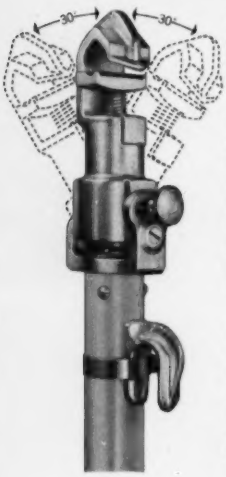

Aluminum alloy head is adjustable 30-degrees either side of center . . . rigid in all positions.

Gives positive control . . . tight grip . . . easiest handling of slack conductors. Enables linemen to maintain required safety clearance when working jumpers on difficult angles. Invaluable for accurately positioning jumpers at maximum reach from pole . . . for making hot line splices and taps.

Clamping screw has smooth, no-drag drive. Yellow Fiberglas handle and plastic covered, laminated fir, clamp-screw operating rod provide maximum safety. Light weight, wide range . . . 6 solid to 336.4 MCM ACSR. Pole length 4′ or 6′.

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The only "dead" or de-energized circuit is a *grounded circuit.* Get safe cable connections . . . less weight . . . with this family of grounding clamps for *aluminum* grounding cable. Ferrules are compressed onto the cable with the WH-1 or WH-2 hydraulic tool . . . threaded into the frame . . . locked with a jam nut. Take 600 volt aluminum grounding cable up to 4/0. Single grounding clamps and 2-, 3-, or 4-clamp cluster sets available in two sizes with ranges from 8 solid to 666.6 MCM ACSR or to 2″-diameter. Jaws of flat face clamp open 1.5″.

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801

New utility equipment

Hunt-Pierce aerial lift

A new line of aerial lifts with advanced design, construction and performance features has been announced by Hunt-Pierce Corp., 59 Meadow St., Milford, Conn. Designed for a wide variety of utility, municipal and industrial overhead operations, the new Servi-Lift units require no outriggers and may be mounted on vehicles as small as 1-ton trucks.

Two standard models are available, one with 36-foot working height, the other with 40-foot working height. Both models are canopy mounted on an "H" frame which leaves deck and compartment space clear and permits mounting with minimum modifications on any standard or existing body. The Hunt-Pierce torsion-bar stabilizer (3-inch diameter steel) pro-

vides complete stability for lift operation, even with the truck in motion.

The entire Servi-Lift structure, which includes crow's nest, upper boom, lower boom, and turret arm, is built of fiberglass for exceptional strength and maximum insulation.

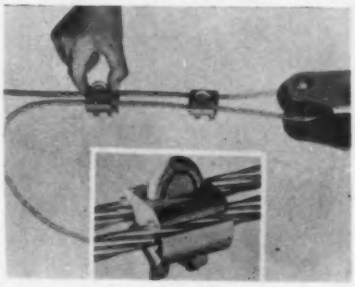
Primary power source is a standard commercial electric generator (3500 watt a-c, 220 volt nominal output, 3 phase, four wire) driven by auxiliary motor or by the truck engine. Normal lift operations use only half the generator output.

Write U-1001 on reply card, pg. 17.

Alcoa loop deadend clip

A new loop deadend clip introduced by Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., affords greatly increased installation convenience as a result of a U-bolt which rotates 90 degrees.

The new clip, Catalog 2412, need never be disassembled for installation. Thus the difficulties that linemen have had installing earlier loop deadend clips, loose parts, requiring



a troublesome, time-consuming, pole-top reassembly of clamp components, have been eliminated by the new design.

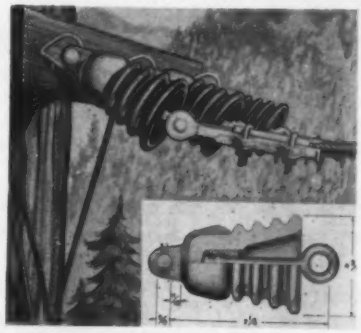
The new clip replaces the familiar catalog 412 type and its modifications. It was designed for use on ACSR (aluminum conductor, steel reinforced) in a range of most-used sizes —#4 through 1/0—and for stranded aluminum conductor of comparable diameter. It may be used on loops formed over either spools or thimbles.

Write U-1002 on reply card, pg. 17.

Rugged strain insulator

A new rugged strain insulator that cuts dead-ending costs is being produced at the Lisbon, Ohio, Thomas Works of Delta-Star Electric Division, H. K. Porter Co., Inc., 2437 Fulton St., Chicago 12, Ill. For use on power lines of up to 12.47 kv, the new unit cuts over-all costs by as much as 40 per cent.

One rugged insulator can be used to do the work of two conventional 6-inch or one 10-inch unit without fear of cross-arm or pole top burning. This allows a large saving on initial cost since the rugged strain insulator costs only slightly more than a conventional 6-inch unit. Installation costs are also cut because



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Fanner Superformed Products

"Superformed* spells S-A-F-E-T-Y to a SAFETY SUPERVISOR"

"We Safety Men must look at any piece of equipment from the *safety* angle.

"Fanner Superforms? Sure, they are safer for our linemen to handle. Not unwieldy . . . no tools required for dead-line application . . . easily controlled with hot-line tools . . . ends are carefully machined to prevent rubber-glove puncturing . . . safer than straight wires and aluminum ribbon."

Everywhere, Safety Engineers, *the men who guard the safety of people*, have a good word for Superforms.

A-1563A

FANNER Superformed with a "PROTECTIVE TWIST"

ARMOR RODS . . . Protect long-span T&D lines at supports

LINEGUARDS . . . Protect short-span T&D lines at supports

PATCH RODS . . . Repair damaged conductors

TAP ARMOR . . . Protects conductor at tapping points

FANNGRIPS . . . For dead-ending strands and conductors

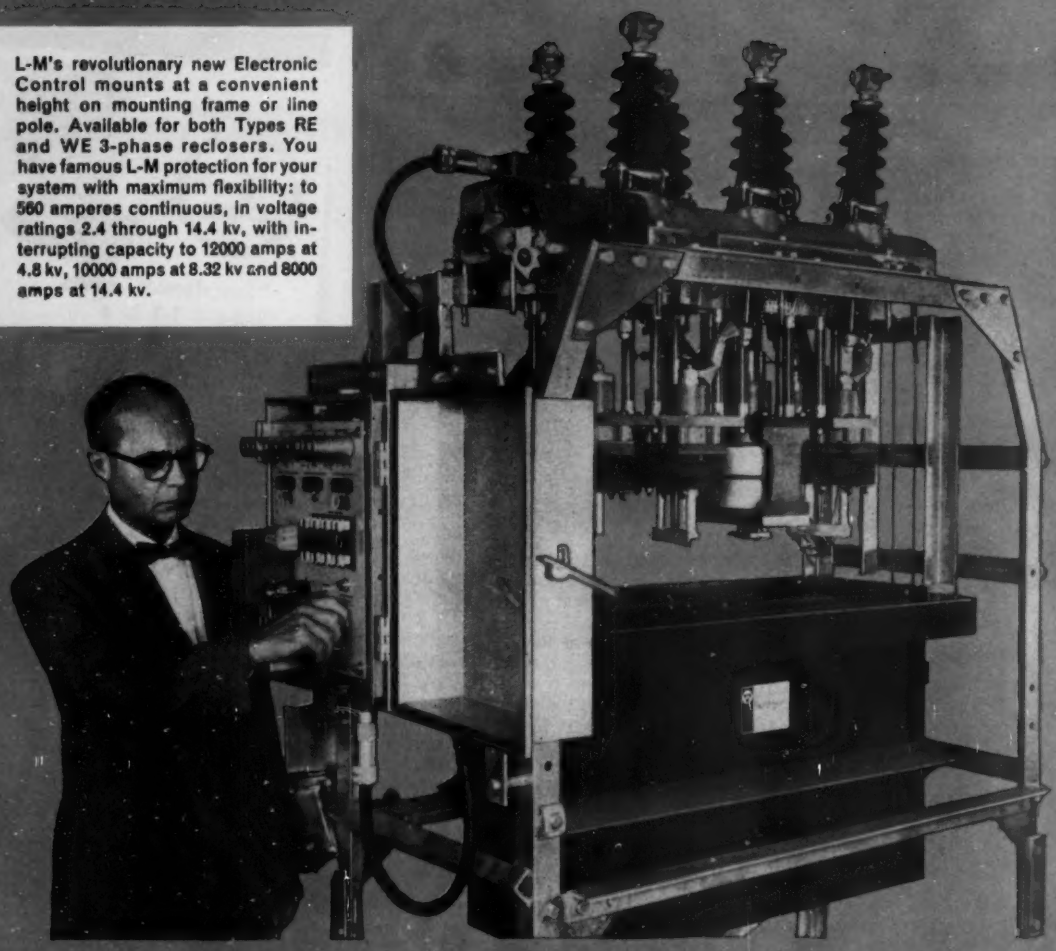
FANNSPLICES . . . Join two ends of conductor wire

PLASTIC PRODUCTS . . . For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

L-M's revolutionary new Electronic Control mounts at a convenient height on mounting frame or line pole. Available for both Types RE and WE 3-phase reclosers. You have famous L-M protection for your system with maximum flexibility: to 560 amperes continuous, in voltage ratings 2.4 through 14.4 kv, with interrupting capacity to 12000 amps at 4.8 kv, 10000 amps at 8.32 kv and 8000 amps at 14.4 kv.



Outstanding Features of L-M Reclosers

- Lowest possible cost—no other device can match L-M's recloser protection for the same money.
- Simple installation—when controls are adjusted you just connect circuit conductors to bushing terminals and recloser is in operation.
- Wholly-contained—requires no auxiliary power supplies or relays whether installed in substation or on pole top.

Now
New L-M Electronic Control Adds:

- Greater control flexibility—minimum trip current, number of operations to lockout, number of fast and retarded operations and time-current characteristics field-changed without untanking or interrupting service.
- Greater Application Flexibility—the basic Electronic control is complete with all control possibilities built in except optional ground trip. All possible protection is contained in one unit.
- Complete test-ability—control may be tested with 120 volts AC with very low current.
- Ground Level Operation—Control panel may be mounted independent of recloser.
- Simplified Coordination—L-M Electronic control offers special operating characteristics apart from time-current characteristics presently offered.

GROUND-TRIP TIMING PLUGS—sealed solid-state components provide two TCC tie ground tripping. Any two may be selected from curves 1, 2, and 3. Field-changed by plugging in different choice.

OPERATIONS COUNTER—electrically counts each recloser opening.

RESET RELAY—Thermal time-delay relay resets if fault clears. New sequence when a new fault occurs. 6 intervals from 10 to 180 seconds. Field-changed by plugging in different relay.

SEQUENCE RELAY—sequences control circuit.

INSTANTANEOUS RESET-CLOSE—by-passes reset time-delay and closes recloser.

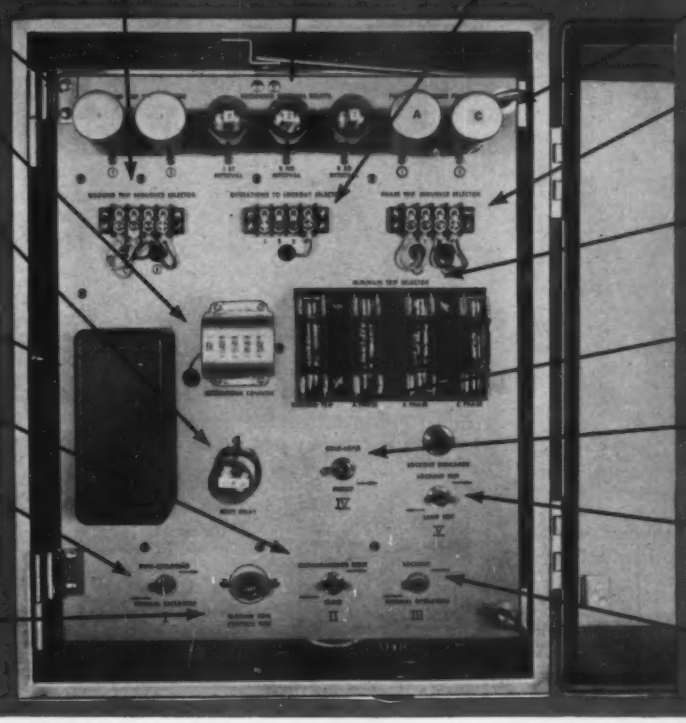
NON-RECLOSING-NORMAL RECLOSING—permits elimination of control sequence. With switch in non-reclosing position, recloser will operate once and lock out.

CLOSING COIL CONTROL FUSE—when line voltage is too low to re-close, fuse blows to prevent operation of closing solenoid coil contactor.

GROUND TRIP SEQUENCE SELECTOR—connections determine the sequence of any two TCC's selected. Field-changed by reconnecting. (OPTIONAL)

RECLOSING INTERVAL RELAYS—thermal relays for intervals between successive reclosings; 6 intervals from 10 to 60 seconds. Field-changed by plugging in new choice.

OPERATIONS TO LOCKOUT SELECTOR—terminal connection determines number of operations to lockout. Field-changed by reconnecting.



PHASE TRIP TIMING PLUGS—sealed solid-state components provide two time-current curves for phase tripping. Any two may be selected from curves X, A, B, C, D or E. Field-changed by plugging in new choice.

PHASE TRIP SEQUENCE SELECTOR—connections determine the sequence of any two TCC's selected. Field-changed by reconnecting.

MINIMUM-TRIP SELECTOR—resistance cartridges for phase minimum trip. Marked in amperes. Field-changed by replacing cartridge.

GROUND-TRIP SELECTOR—resistance cartridge for minimum trip, marked in amperes. Field-changed by replacing cartridge. (OPTIONAL)

COLD-LOAD PICKUP—prevents recloser from opening during service restoration current surges.

LOCKOUT INDICATOR—signal lamp for visual indication when recloser locks open; Momentary switch tests lamp in one direction, and indicates lockout of recloser in the other.

LOCKOUT-NORMAL OPERATION—locks recloser open from control panel.

L-M's New Electronic Control Provides Greater Flexibility For Reclosers

Relay, System Protection and Substation Engineers will find that the new Type RE and WE Reclosers offer the ultimate in coordinated system protection.

by **N. K. DELANEY**
Product Manager,
Switchgear and Capacitors
Line Material Industries

Oil Circuit Reclosers as developed by Line Material some years ago have been universally accepted as tremendously efficient, cost-saving protection for distribution lines and substations.

One reason for L-M's outstanding leadership in reclosers has been the L-M-developed hydraulic control, which is extremely dependable, and well accepted.

Today Line Material announces another revolutionary new engineering development—the L-M *Electronic* Control.

The *Electronic* control consists of a solid-state transistorized sensing and control device: time-delay relays for resetting and reclosing; provisions for ground current tripping; test and control switches; and plug-in components to provide for changing time-current curves and sequences without service interruptions. The L-M Electronic control provides greater flexibility, greater accessibility, and a wider choice of time-current curves than have been available even with L-M's outstanding hydraulic control.

Now Get Electronic Coordination

Get complete details on this outstanding improvement by Line Material in automatic line protection. Ask the L-M Field Engineer for Product Information Bulletin CR1WE, and ideas on how you can take advantage of this remarkable new development in oil circuit reclosers. Call the nearest L-M office; or phone or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Reclosers, Sectionalizers, and Oil Switches

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

only one insulator is installed in place of two.

Further reasons for the cost cutting include the insulator's new tubular contour, which practically eliminates fissure during handling. Impact forces are spread over the entire body instead of on a single porcelain projection. During hot line construction on nearby equipment, the rugged strain insulator lends itself to easy covering due to its smaller diameter.

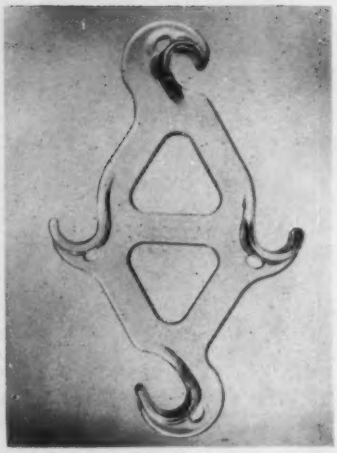
Write U-1003 on reply card, pg. 17.

Anaconda transmission system

An economical electrical transmission system employing insulated conductors and plastic spacers has been introduced by Anaconda Wire & Cable Co., Dept. EFL, 25 Broadway, New York 4, N. Y. Designated Spanway, the new system consists of one to three phase conductors, messenger, and Spanway spacers, and is capable of carrying conductors up to 400 Mcm and voltages up to and including 15 kv.

Conductors are hard-drawn stranded aluminum, covered with weather-resistant black polyethylene. The standard messenger is 5/16-inch 30 per cent extra high strength Copperweld steel. Other messenger sizes can be supplied as required.

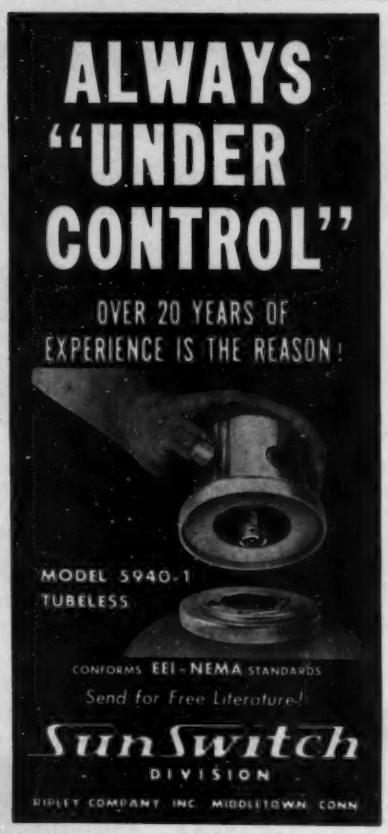
The spacers, molded of an acrylic



plastic with high resistance to weathering and tracking, hold the phase conductors in a 6-inch triangular configuration supported from the messenger. Each spacer also acts as an insulator and so reduces the conductor covering thickness necessary to prevent voltage breakdown.

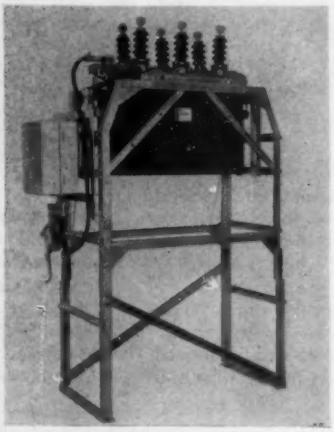
The compact, lightweight spacer features low leakage and high corona levels when exposed to wet atmospheric conditions. The single size, approximately 7¾ x 13 inches, may be used for 5 kv to 15 kv installations.

Write U-1004 on reply card, pg. 17.



L-M oil circuit reclosers

Two new oil circuit reclosers, among the first known to feature electronic control, are now offered by Line Material Industries, 700 W. Michigan St., Milwaukee 1, Wis. Designated Types RE and WE, the new reclosers embody all the advantages of previous reclosers and pro-



vide increased flexibility and ease of installation, testing, and adjusting. Type RE reclosers are rated 400 amperes continuous and can interrupt up to 4000 amperes at 14.4 kv. Type WE reclosers can carry 560 amperes continuously and interrupt up to 8000 amperes at 14.4 kv.

Both reclosers feature choice of two fast and four retarded time-current curves which can be employed in a sequence consisting of one, two, three, or four operations to lock-out. Minimum-trip settings range from 100 to 1120 amperes and different reclosing intervals can easily be obtained. Ground-fault tripping can be provided for currents down to 50 amperes.

Types RE and WE reclosers can clear fault currents in 2½ cycles or less over most of their operating ranges.

Write U-1005 on reply card, pg. 17.

500-kva pole transformers

Three 500-kva distribution transformers designed by the Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa., were shipped to a shopping center in Houston, Tex., recently.

An extension of the higher kva line of distribution transformers, these are

among the first pole-type units of this rating to be shipped in this country. The transformers will be installed on a rack to avoid the expense of constructing a ground-type substation. These new 500-kva transformers were designed to provide lower electrical losses which will result in a definite operating cost advantage over most older substation designs.

Write U-1006 on reply card, pg. 17.

Holan power derrick

A new corner-mounted power derrick, designed especially for working in narrow streets, alleys and congested areas, is being manufactured by Holan Corp., 4100 West 15th St., Cleveland 35, Ohio.

Engineered as a complete unit to avoid body and derrick stresses, the new derrick, known as the 7500, has a horizontal sweep of 110 degrees to permit boring and pole-setting behind and to the curbside of the truck. Holes up to 30 inches in diameter can be bored as deep as 8 feet without using an auger extension, and 12-foot holes can be bored with an auger extension.

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"Superforms* help me keep lines in service"
...DISTRIBUTION ENGINEER

"To me, the word 'Superformed' means a number of plus values:

"*Service continuity* to keep our customers satisfied . . . *low maintenance costs* . . . in short, *greater dependability* and *savings*."

Everywhere, Distribution Engineers . . . *the men technically responsible for keeping customer lines in service* . . . acclaim Fanner Superforms. A-1586A

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"PROTECTIVE TWIST"

ARMOR RODS...
Protect long-span T&D lines at supports

LINEGUARDS...
Protect short-span T&D lines at supports

PATCH RODS...
Repair damaged conductors

TAP ARMOR...
Protects conductor at tapping points

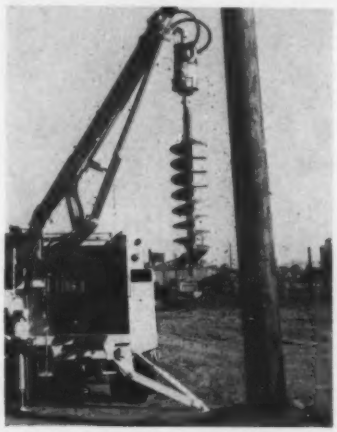
FANNGRIPS...
For dead-ending strands and conductors

FANNSPLICES...
Join two ends of conductor wire

PLASTIC PRODUCTS...
For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

The derrick is mounted on the left hand side of the body, but right hand side mounting is available. A unique semi-automatic locking device for the



earth borer allows the borer to be moved by the extendible boom or locked for storage at the end of the main boom. When finishing boring, the operator merely retracts the boom and the borer automatically locks itself onto the main boom. When the extendible boom is needed again, it moves out free of the earth borer.

The 7500 has an up and down feed pressure ranging from 3600 to 5400 pounds approximately twice that of modern corner derricks, and will handle any derrick suspended digger. It is the only corner derrick capable of handling Holan's powerful 3-speed Series 5400 Earth Borer.

Write U-1007 on reply card, pg. 17.

Hydraulic aerial bucket lift

Pitman Manufacturing Co., Grandview, Mo., has developed a low-cost, all-hydraulic fiberglass aerial bucket that lifts men as high as 40 feet to

work without exertion or danger. This unit, the Pitman Pelican, consists of a rotating boom and bucket with dual controls. The entire telescoping section of the boom, as well

NEW
PENGO
POLE-MOUNT
TENSIONER

Now...PENGO 4000 Tensioner Takes Conductor to 336,500 cm-ACSR or 397,500 cm-AAC —Tensions to 1,000 Pounds!

Here's a bullwheel tensioner you can carry in every line truck! It features two 18 inch neoprene lined bullwheels. Tru-Stop disc brake – yet weighs so little it's truly portable.

Two men can easily place the 4000 PM against the pole, attach it (chains and wing-nut tightener are permanently attached to tensioner), and start stringing in a matter of minutes. Conductor can be payed off any suitable reel stand. A collapsible reel attached to a winch shaft makes a practical puller, although any type of power previously used for pulling can be used.

TENSION WIRE STRINGING is the safe, economical modern way to string distribution and transmission lines. Why not get the facts? Write for new PENGO catalog TSE-1 for full data on the world's largest, most complete line of tension stringing equipment. Please address Dept. 33.

PETERSEN
ENGINEERING CO., INC.
460 Kifer Road
Santa Clara, California
Phone: AXminster 6-7712
9-15

as the bucket, is fiberglass for electrical safety and has a capacity of 300 pounds.

An operator simply steps into the bucket, with whatever tools he needs for the job. Convenient controls on the bucket's rear lip sends him aloft in seconds. The boom revolves 360 degrees in either direction, elevates to 75 degrees above horizontal, and extends to maximum reach in less than a minute.

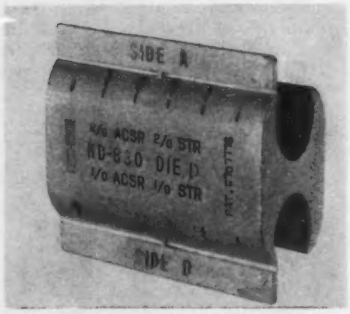
These movements are simultaneous or individual, with the operator in complete control at all times. The bucket levels itself hydraulically as boom elevates. Dual controls on the truck also control rotation, elevation and extension simultaneously.

Write U-1008 on reply card, pg. 17.

Compression tap connectors

Penn-Union Electric Corp., 315 State St., Erie, Pa., announces the addition of a complete line of spacer type compression tap connectors of the "H" frame design for cable sizes from #6 solid through 400 MCM stranded aluminum or copper cable.

These compression fittings use the conventional "O" and "D" compression dies up through 4/0 stranding. They utilize a new die size "N" from 4/0 through 400 MCM stranded cable. All popular sizes feature a



double - tabbed reversible design which permits the connectors to be reversed for flexibility between run and tap size requirements. This also accomplishes a major reduction in the stock requirements needed.

All connectors are made of high conductivity EC grade aluminum extrusions assuring cool running contacts. For easy crimping, high efficiency contacts and protection to the run conductor, all conductors are fully annealed.

Heavy chamfering at cable openings and the use of full length tabs also assures additional protection to the main cable and the inhibitor.

All connector grooves are cleaned of aluminum oxides, then inhibited with Penn-Union's non-running, non-rubber-irrating Cual-Aid and the entire connector packaged in a printed sealed polyethylene bag for preservation of the oxide-free contact surfaces.

The use of a spacer permits the recommendation of this connector with copper, aluminum or ACSR.

Write U-1009 on reply card, pg. 17.

High-voltage a-c test set

Multi-Amp Electronic Corp., 465 Leigh Ave., P. O. Box 217, Union, N. J., has developed a variable high-voltage a-c test set for making dielectric strength measurements. It is an

addition to the company's line of testing and calibrating equipments.

Designed to provide up to 40 kv, the set can be used as a power supply for tests to be made in accordance with ASTM Specifications D-149 and Federal Specifications LP-406, Method 4031. Some specific tests are checking transformer oil, electrical tape, rubber blankets, sheet laminates and lineman's gloves, as well as "hi-poting" generators, motors, transformers, and other apparatus.

This self-contained set includes controls, oil test jig, and metering. Output control has synchronous-motor drive to increase the output at a rate of 1000 volts per second until breakdown occurs. Manual control is provided for other rates of voltage rise or constant-voltage operation. The built-in oil test jig has a removable cup with 1-in. diameter electrodes spaced 0.1 in. apart. Other jigs can be supplied as plug-in interchangeable units. A cable connection can be made for external testing.

Write U-1010 on reply card, pg. 17.

Tri-Unit voltage regulator

A new concept in voltage regulating equipment, called the Pole Star Tri-Unit Regulator, has just been introduced by Pennsylvania Transformer Division, McGraw-Edison Co., Box 330, Canonsburg, Pa.

The new Tri-Unit Regulator consists of three well-known standard

Ventilate and Heat that manhole
Safely
with a
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propane
VENTILATING HEATER
Fresh Air... heated fresh air in one portable unit!
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Order through your favorite distributor.
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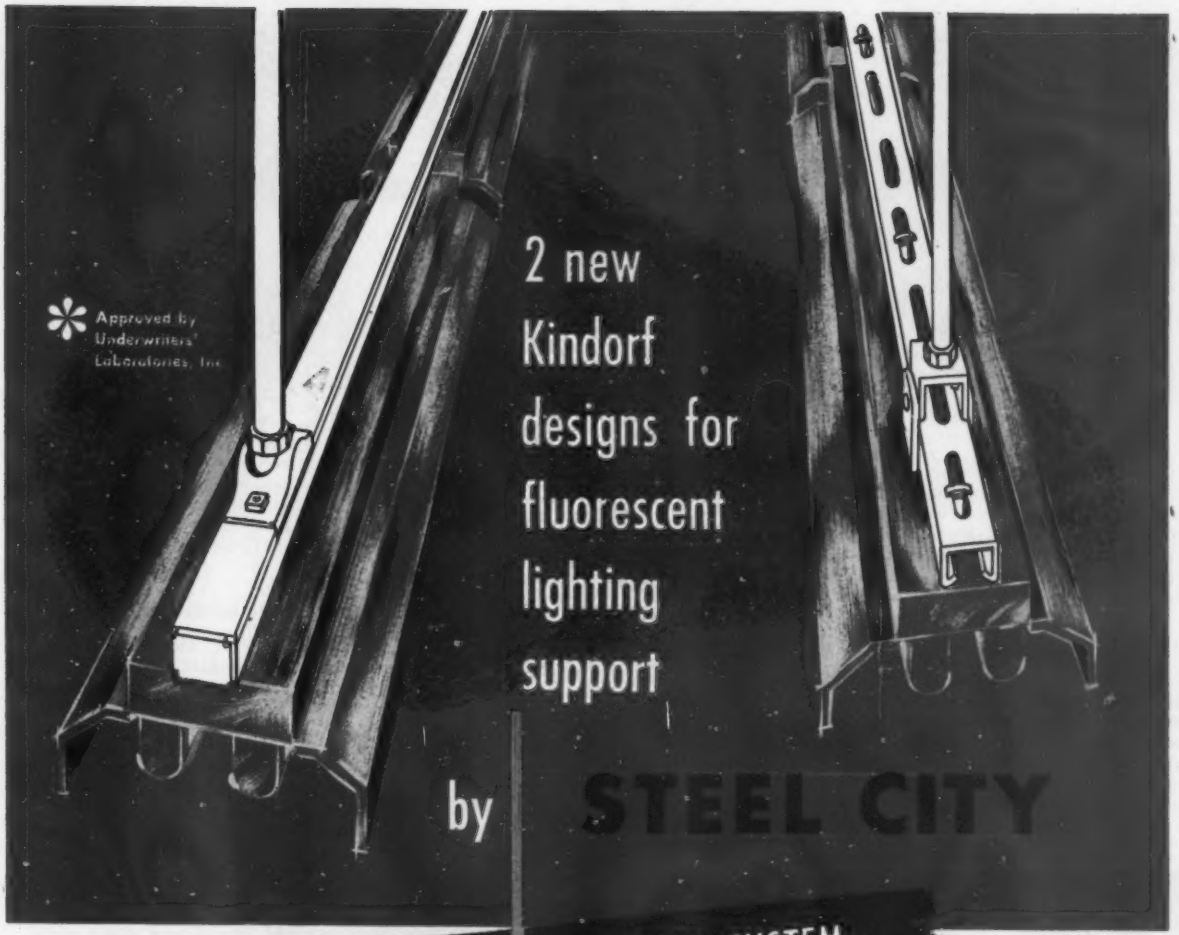

* SURFACE RACEWAY SYSTEM

Specially designed for use as a combination surface raceway and flush-mounting fluorescent fixture support. Completely enclosed from outlet box to fixture to eliminate the clutter of external conductors, this system also protects the wiring from physical damage. It's simple "slot-up" design makes it easy to install . . . easy to wire.

SIMPLEX SYSTEM

A fluorescent fixture *support* system only, its channel is applied slot-side down, and is not intended for use as a raceway. This system combines economy of investment with maximum strength and rigidity. It is easy to install and fixtures may be attached, or relocated, without lowering, or otherwise disturbing the basic channel assembly.

Write for our product bulletin g-2. "STEEL CITY lighting supports (Kindorf channel type)."

designed by electrical engineers
made by a leading electrical manufacturer
for the electrical trade.

products of

STEEL CITY
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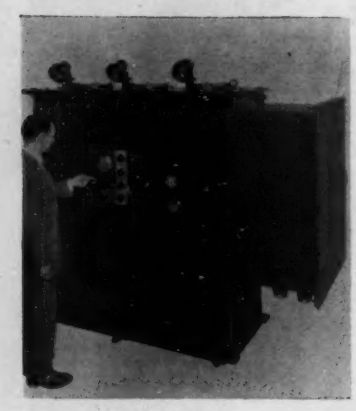


distribution-type Pole Star regulators —each a fully-automatic, self-contained unit—combined in a single tank. All necessary interconnections between phases are self-contained. The unit can be equipped with bushings for open-wire line connection, or a terminal compartment for cable connection.

The new regulator provides the economic and operating advantages of independent phase regulation, compared to regulation with three-phase gang control. At the same time, there is the simplicity and economy of three-phase installation.

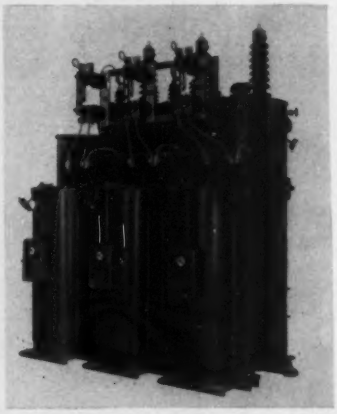
Capacities available are based on the tri-unit combinations of all standard single-phase Pole Star Regulators. Voltage ratings are 15 kv and below. Regulation is plus and minus 10 per cent in 32 steps of ⅝ per cent.

Write U-1011 on reply card, pg. 17.

Compact substation unit

A new, economical approach to substation planning has been introduced by Allis-Chalmers Manufacturing Co., 938 S. 70th St., Milwaukee 1, Wis., to provide improved service, maximum flexibility and safety, and minimum maintenance.

The compact, new Regu/Tran assembly consists of three single-phase regulators directly mounted on a



three-phase power transformer with a by-pass switch located above each regulator.

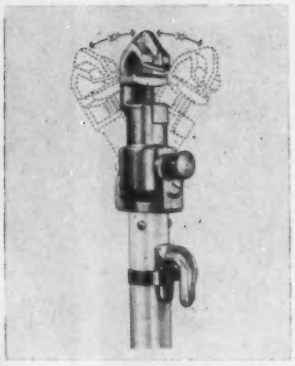
This simplified arrangement gives single-phase regulation with three-phase unit assembly. As a result, the Regu/Tran unit conserves valuable substation space by requiring only one low-cost concrete pad for mounting the entire assembly. In addition, it offers flexibility through single-phase regulation to substations having outgoing feeder handling single-phase loads on all three phases.

Write U-1012 on reply card, pg. 17.

Kearney jumper holding tool

A new yellow fiberglass jumper holding tool recently announced by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., features an adjustable aluminum-alloy head which can be positioned 30 degrees either side of center. The adjustable head provides better control and easier handling of slack conductors.

With the new tool, linemen can more easily maintain the required safety clearance when working on jumpers at difficult angles. Jumpers can also be more accurately positioned at maximum reach from the pole when making hot line splices and taps. Maximum safety is provided by a yellow fiberglass handle and a plastic-covered laminated fir operating rod.



Pole is tested to withstand 75 kv per foot for 5 minutes. Clamp screw has smooth, no-drag universal drive.

Write U-1013 on reply card, pg. 17.

Jasper steel screw anchors

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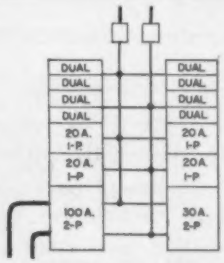

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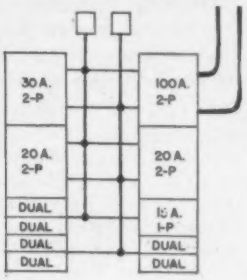

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WALKER DIVISION

Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ SOME CONTROL circuits carry the main load current—the switch loop of a light, of a group of lights, or of a small motor, for instance. The Code rules for conductor overcurrent protection are in no way modified for this type of "control" circuit. Most circuits referred to as control circuits, however, are of the type which do not carry the main load current. A remote control circuit is by definition (Article 100) "Any electrical circuit which controls any other circuit through a relay or an equivalent device."

Section 430-71 of the Code modifies the general requirements listed in Part A of Article 430 for motors insofar as these rules apply to motor control circuits. In order to indicate clearly that such modification applies only to control circuits which do not carry the main load current, a fine print note following the section further defines a control circuit as follows:

"The control circuit of a control apparatus or system is the circuit which does not carry the main load current, and by means of which the electric signals directing the performance of the controller are transmitted." Section 430-72 then indicates that control circuits are considered sufficiently protected " . . . *by the branch-circuit overcurrent protective devices under any of the following conditions . . . :*"

"(1) *Where the rating or setting of the branch-circuit overcurrent device is not more than 500 per cent of for the carrying capacity of the control-circuit conductors.*

"(2) *Where the controlled device and the point of control (start and stop buttons, pressure switch, thermostatic switch, etc.) are both located on the same machine and the control circuit does not extend beyond the machine.*

"(3) *Where the opening of the control circuit would create a hazard; as for example, the control circuit of fire-pump motors, and the like.*"

A reference in Section 430-72 is made to Exception No. 5 in Section 240-5. This Exception No. 5 permits the 500 per cent factor to apply to any remote control circuit provided that the branch-circuit overcurrent protective device is *not* of the " . . . so-called time-lag type . . . " and provided further that the rules in Article 725 are

---

Code test questions

1. For a stationary motor of ⅛ horsepower or less, which is normally left running, and which is so constructed that it cannot be damaged by overload or by failure to start, the branch circuit fuse may serve as the means for starting and stopping. True or false?

2. A portable motor of ⅓ hp or less is permitted by the Code to be started and stopped by means of an attachment cap and receptacle. True or false?

3. Although an auto-transformer type motor starter is required to have a running position and a starting position, it is not required to have an off position. True or false?

4. The point or plate on a motor starting rheostat on which the arm rests when in the starting position shall have no electrical connection with the resistor. True or false?

5. Motor starting rheostats shall be so designed that the contact arm can be left on intermediate segments. True or false?

6. Conductors of motor control circuits shall be considered as being properly protected by the branch-circuit overcurrent device where the rating or setting of this device does not exceed:

(a) 300 per cent of the carrying capacity of the control circuit conductors.

(b) 400 per cent of the carrying capacity of the control circuit conductors.

(c) 500 per cent of the carrying capacity of the control circuit conductors.

Which is correct? a? b? or c?

7. Motor-starting rheostats for direct-current motors shall be equipped with automatic devices which will interrupt the supply before the speed of the motor has fallen to less than:

(a) one-half its normal value.

(b) one-third its normal value.

(c) one-fourth its normal value.

Which is correct? a? b? or c?

8. Adjustable-speed motors that are controlled by means of field regulation, unless designed for such starting, shall be so equipped and connected that they cannot be started:

(a) under high resistance field.

(b) under weakened field.

(c) under d-c field.

Which is correct? a? b? or c?

9. Unless under the manual control of a qualified operator, or unless the speed is limited by means of the connected load, speed-limiting devices shall be provided for:

(a) series motors.

(b) split-phase motors.

(c) induction motors.

Which is correct? a? b? or c?

10. Controllers for motors of over 50 hp:

(a) may be of the general-use type rated in amperes.

(b) are required to be rated in amperes.

(c) are required to have horsepower ratings.

Which is correct? a? b? or c?

Correct answers will be found at end of article on page 143.

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Aurora, Illinois

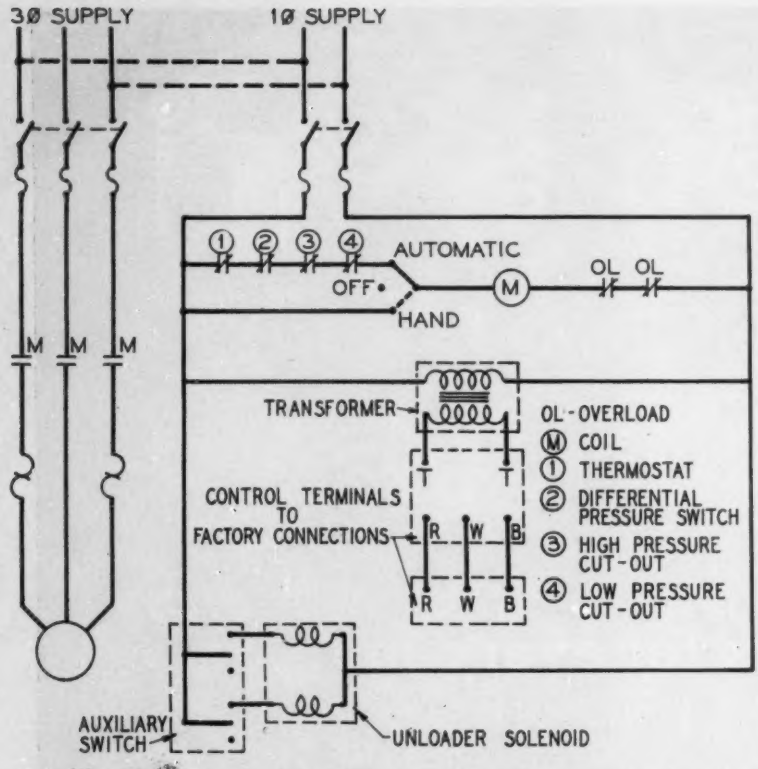


Fig. 1—Whether control disconnect is supplied by a separate source or by tapping ahead of the motor disconnect, it should be adjacent to the motor disconnect as shown here for a typical installation.

not violated for remote-control, low-energy power, low-voltage power, and signal circuits.

However, since the exception in Section 430-72 is an exception to Exception No. 5 in Section 240-5, and since the time-lag feature is not mentioned in Section 430-72, there is no rule against motor-control circuits being protected by branch-circuit overcurrent devices which are 500 per cent of the rating of the control conductors even if such branch-circuit overcurrent devices are of the time-lag type.

It is permissible, therefore, to protect a motor-control circuit having No. 12 conductors with a branch-circuit overcurrent device rated at not more than 100 amperes. If the branch-circuit overcurrent device exceeds 500 per cent of the carrying capacity of the control conductors, then the control conductors must be provided with their own overcurrent devices unless the motor drives a fire pump or similar device or unless the controlled device and the point of control are both located on the same machine. In the latter case, although not required by the Code, overcurrent devices for the control conductors should be installed in any case where the 500 per cent factor is exceeded.

Mechanical protection

Mechanical protection for control circuits is required by Section 430-73. This section requires that all control conductors outside of the control device enclosure be protected by a raceway or equivalent protection if damage to the control circuit would constitute a life or fire hazard. Section 725-17 requires such circuits under such conditions to be installed in conduit, EMT, or Type MI cable or to be provided with equal protection.

A fine print note following Section 430-73 recommends that control circuits be so connected that an accidental ground would not start the motor. Some inspectors would like to see this recommendation become a Code requirement. There is no question about the danger of motor installations which could result in accidental starting. Fortunately, however, this type of accident resulting from this cause is very rare.

The control circuits are required by Section 430-74 to be disconnected from all sources of supply when the disconnecting means is in the open position. This section permits two separate disconnecting means to be used—one for the motor and one for the control conductors. If two are used, however, they should be grouped side by side. See Figure 1.

Paragraph (b) of Section 430-74 requires any control transformer which is located within the controller to be connected to the load side of the disconnecting means.

Suitable controllers

All motors are required to be provided with suitable controllers. Article 100 defines a controller as "A device, or group of devices, which serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected." To this general definition of a controller, Section 430-81(a) adds the following special definition of a motor controller: "For the purpose of this Article, the term 'controller' includes any switch or device normally used to start and stop the motor."

Stationary motors of ⅛ horsepower or less which cannot be damaged by overload or failure to start are permitted by Section 430-81(b) to be controlled by the branch-circuit overcurrent device. I personally do not recommend this practice, especially where the overcurrent device is a fuse. The insertion and removal of a fuse for starting and stopping a motor is amateurish to say the least. The Code permits this only for such motors which are normally left running, but it is poor practice in any case.

Portable motors not exceeding ⅓ horsepower are permitted by Paragraph (c) of this section to be controlled by an attachment cap and receptacle. Most motors, fortunately, are usually provided with a start-and-stop switch by the electrician if a built-in switch is not provided by the manufacturer. (Although I do not personally know of any accidents resulting from controlling motors in this manner, I do know of a couple of cases of severely burned wrists where cords shorted when attachment caps and receptacles were being used to turn off heating appliances.)

Section 430-82 states, "Each controller shall be capable of starting and stopping the motor

which it controls, and for an alternating-current motor shall be capable of interrupting the stalled-rotor current of the motor."

Horsepower ratings

Section 430-83 requires all motor controllers to have a horsepower rating at least equal to the horsepower rating of the motor which it controls except as follows:

(1) A stationary motor of 2 horsepower or less and 300 volts or less may be controlled by a general-use switch with an ampere rating of at least twice the full-load ampere rating of the motor; or, on a-c circuits, by an a-c general-use snap switch where the motor full-load current rating does not exceed 80 per cent of the current rating of the switch. (The a-c/d-c snap switches cannot be used for this purpose.)

(2) A circuit breaker rated in amperes only is permitted to be used as a motor controller.

(3) Controllers on sealed hermetic-type refrigeration compressor motors are required to have the continuous duty full-load current rating and also the locked-rotor current rating of the compressor motor. Where a controller which is to be used on a hermetic-type motor is rated in horsepower only, the equivalent full-load current rating can be determined from Tables 430-148 through 430-150, and the equivalent locked-rotor current can be determined from Table 430-151. (If the equivalent current ratings are less than those of the compressor motor, a larger controller must be used.)

It should be noted, and noted well, that motors rated in excess of 50 horsepower are required by Section 430-83 to have horsepower-rated controllers. There *is* an exception to the horsepower rating of *disconnecting means* for motors of over 50 hp, as we shall see in the next issue of ELECTRICAL SOUTH. But there is *no exception* for the *controller* for motors of over 50 hp.

A controller is not required to open all conductors of a motor circuit except as follows: (1) When the controller serves also as the disconnecting means; and (2) where one pole of a controller opens a grounded conductor. In the latter case, not only must it open all conductors, but it must open them simultaneously. (In the case of space heating equipment, controllers which have a position marked "off" are required to simultaneously open all ungrounded conductors, but this requirement does not apply to motor circuits. Space heating equipment controllers are not required to open all ungrounded conductors if the word "off" does not appear on the controller.) Most motors larger than 2 hp, however, are usually provided with controllers which, when in the open position, do open all of the motor circuit conductors.

Where a motor and its driven machinery is out of sight from the controller, the controller or the disconnecting means must be capable of being locked in the open position, or a manually-operable switch must be installed within sight of the motor. The manually-operable switch may be a snap switch in series with the controller's holding coil or it may be a disconnecting switch which opens the main-load current. If it is the latter type switch, it must meet the requirements for the motor disconnecting means. (The Code requirements for motor disconnecting means will be discussed in the next issue of ELECTRICAL SOUTH.)

Multi-motor controllers

The Code rules permitting more than one motor on one controller are less strict than the rules for protecting more than one motor with a single set of branch-circuit overcurrent devices which have already been discussed in an earlier issue in this department. Section 430-87 requires that each motor be provided with its own individual controller except that for motors of 600 volts or less two or more motors may be grouped on a single controller under any of the following conditions:

(1) Where two or more motors drive several parts of a single machine.

(2) Where two or more motors are protected by a single branch-circuit overcurrent device.

(3) Where two or more motors are located in a single room and all are within sight of the controller.

Unless there are other reasons for controlling several motors by a single controller other than the "reason" listed in (3) above, good practice dictates that each motor be provided with its own controller. (Code rules for two or more motors connected to a single disconnecting means will be discussed in the next issue.)

Speed limiting devices are re-

(Continued on page 143)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Venting requirement for Askarel-filled transformers

QUESTION: I have installed an Askarel filled transformer in an inside location, and the inspector has ruled that it must be vented. I have never heard of such a rule for Askarel transformers. The inspector said gases would be generated by arcing. But I would like to quote from the Code itself in Article 100: "Askarel: A synthetic nonflammable insulating liquid which, when decomposed by the electric arc, evolves only nonflammable gaseous mixtures." I would like to have your opinion of this venting which the inspector is requiring.

ANSWER: Much depends upon the size of the transformer and upon ventilation. (If over 15,000 volts, it must be in a vault.) I will quote Section 450-23 which will completely answer your question.

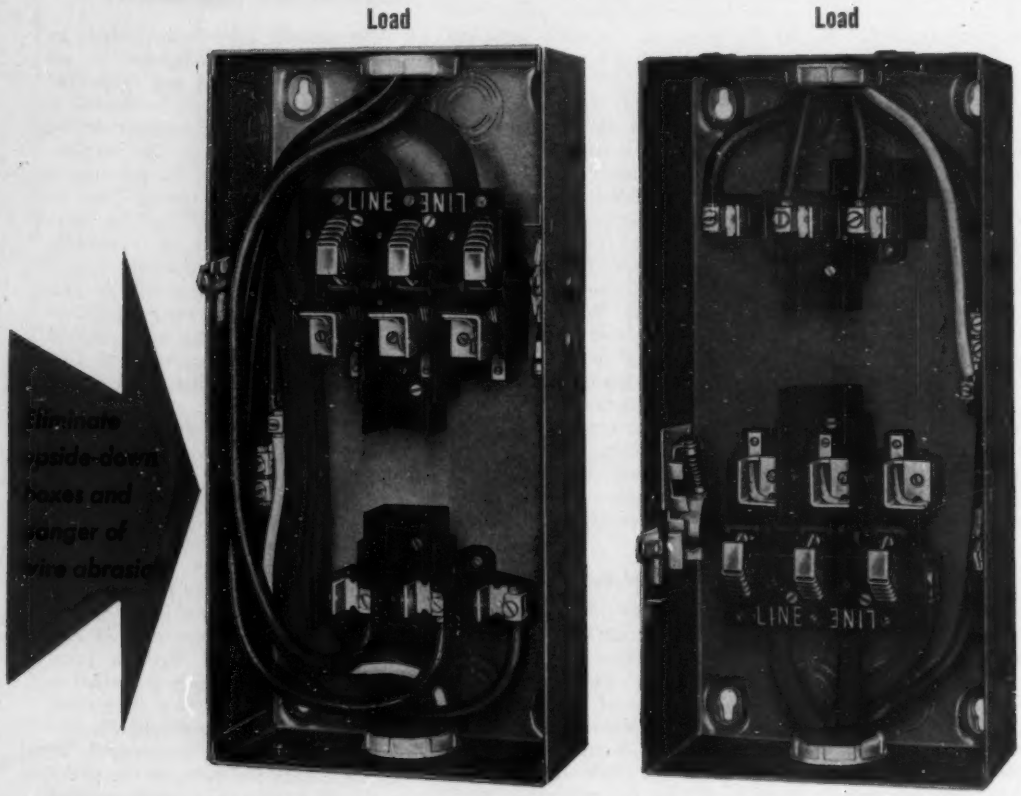
This section states, "Askarel-Insulated Transformers Installed Indoors. Askarel - insulated transformers rated in excess of 25 kva shall be furnished with a pressure-relief vent. Where installed in a poorly ventilated place they shall be furnished with a means for absorbing any gases generated by arcing inside the case, or the pressure relief vent shall be connected to a chimney or flue which will carry such gases outside the building. Askarel-insulated transformers rated more than 15,000 volts shall be installed in a vault."

Permissible use of ½-inch outlet box

QUESTION: A question has arisen here with our firm concerning the proper use, according to the NEC, of ½-in. deep 3¼-in. boxes and the limit on the number of wires allowed in one.

Section 370 is the only thing we can find in boxes less than 1½ inches deep. We have used these boxes on the lowering of ceilings with one 2/14 Romex cable in them; also for use with one 2/14 Romex cable where siding is being put on as we can bring the wire out and adjust our ½-in. by 3¼-in. box over the wire in such a position as to have a completely

Save up to $30 on cable cost with new G-E reversible-wiring safety switches



Old way wastes wire, work and money. Looped cable inside box presents danger of wire abrasion. None of this is necessary when you use new General Electric reversible-wiring safety switches, 100-amp and above.

New G-E way eliminates danger of wire abrasion, inconvenience of upside-down boxes. ON-OFF indication remains unchanged. Available with line lugs factory-installed at bottom, or for field installation.

SCHEDULE OF SAVINGS ON CONDUCTOR COSTS

Switch Rating	Conductor Size	Amount Saved Per Switch Installed*		Length of Wire Saved (In Feet)	
		2-Pole	3-Pole	2-Pole	3-Pole
100 AMP	2	$ .91	$ 1.36	5	8
200 AMP	3/0	3.73	5.60	9	14
400 AMP/240 VOLT	500 MCM	12.56	18.90	11	16
400 AMP/600 VOLT	500 MCM	13.74	20.60	12	17½
600 AMP/240 VOLT	(2) 350 MCM	18.70	28.10	22	33½
600 AMP/600 VOLT	(2) 350 MCM	20.40	30.60	24	36½

*Based on approximate contractor prices for Type RHW copper building wire.

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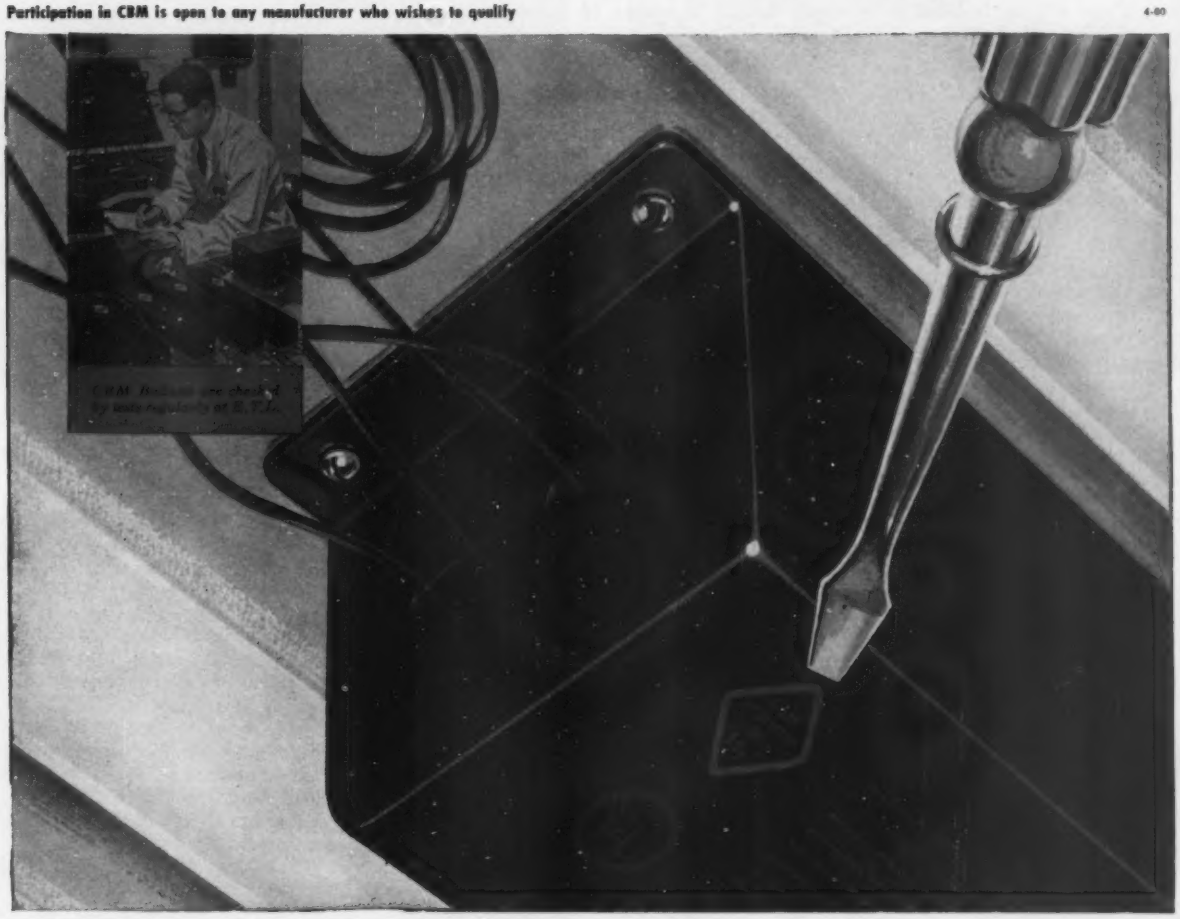

Among them . . . up to 40% more light output and sustained peak light output to give the benefits of today's recommended higher lighting levels. You also get long lamp and ballast life . . . positive starting . . . U. L. listing . . . **in short, performance that meets specified CBM standards** . . . checked and certified by Electrical Testing Laboratories. Enjoy CBM benefits on fixtures that you sell or specify. And to keep pace with CBM progress, ask us to start mailing you "CBM NEWS".

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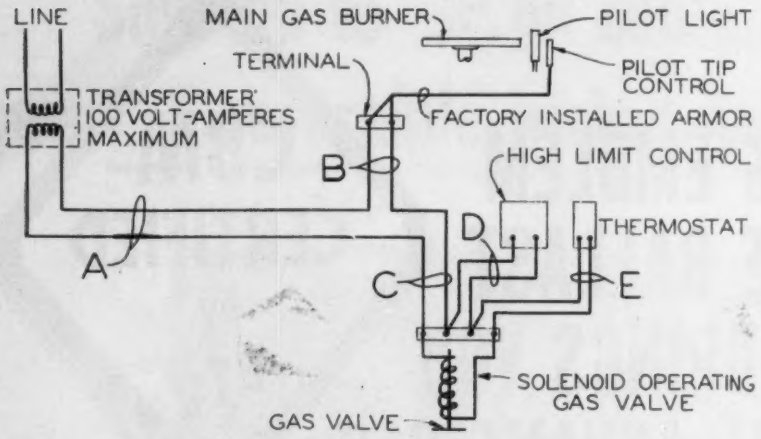

Fig. 1—In this wiring diagram of controls for a gas heating system, the circuits labeled B and D constitute Class 1 circuits, according to requirements in Section 725-6. They should be wired in conduit, EMT, or Type MI cable because a short circuit in either of these would constitute a direct fire or life hazard.

flat surface to mount our porch fixture on.

These boxes have flat clamps and the UL label. Our question is: are we using these boxes illegally; and if so, please define a legal place to use them.

ANSWER: Such concealed boxes by the provisions of Section 370-14 may be used only where it is impracticable to use a box of 1½ inches in depth without damaging the building structure. The word *impracticable* means incapable of being put into practice, hence this word is almost interchangeable with the word *impossible*. Therefore, if it is impossible for a concealed box of 1½ inches in depth to be used without damage to the building structure, a box with ½ inch depth may be used. Not more than 3 No. 14 wires may be used in such a box having a clamp.

Wiring provisions for show windows

QUESTION: Please advise your interpretation on the following question: Section 220-2c2. Building is an open prestressed roof and is to be used as a retail store. Window space is 30 lineal feet. Customer insists it is not necessary to run circuits to window areas, as long as service is adequate for computed load.

ANSWER: This question has been kicked around from time to time, perhaps because there seems to be a degree of vagueness connected with show-window requirements. However, the Code does require circuits for show windows. It also requires feeder capacity for them as well as the service capacity which you mentioned in cases where feeders would serve such areas. As for outlets, however, receptacle outlets are not required by the Code except where portable cords are used in such windows.

Branch circuit rule

Section 220-1 in referring to Article 220 states, "This Article provides the basis for calculating the expected branch circuit and feeder loads and for determining the number of branch circuits required." (Note the word *required*.)

Section 220-2 states, "The load for branch circuits shall be computed in accordance with the provisions of this section." Paragraph c of this Section allows, by Exception No. 2, a load of 200 watts for each linear foot of show window in lieu of the unt loads per outlet specified in Paragraph b of this Section. This same load of 200 watts per linear foot for show windows is required by Section 220-4(b) to be added to the feeder capacity.

Therefore, we have requirements for feeder capacity and for circuits. So far, however, we have no requirements for outlets in show windows other than Section 210-22 which requires outlets where portable cords are used. Section 410-53 requires outlets to be approved for the location when installed in floors with an exception permitted for receptacles installed in elevated floors such as show windows if the inspector considers them to be not subject to physical damage.

It is my opinion, therefore, that feeder capacity and sufficient circuits necessary to provide 200 watts for each linear foot of show window is required by the Code. It is my opinion also that it is the intent of the Code that receptacles be provided as needed for these circuits.

Class 1 circuits under Section 725-6

QUESTION: Please examine the enclosed sketch and indicate which parts lettered A, B, C, D, and E constitute Class 1 circuits by reason of the requirements in Section 725-6.

ANSWER: Section 725-6 states, "Safety Control Devices. Remote-control circuits to safety-control devices, the failure of operation of which would introduce a direct fire or life hazard, shall be considered as Class 1 circuits."

This is followed by a fine print note which states, "Room thermostats, service hot water temperature regulating devices, and similar controls used in conjunction with electrically-controlled domestic heating equipment, are not considered to be safety-control devices."

In the light of this section and its fine print note, it appears that the circuits labeled B and D in your sketch (See Figure 1) would be Class 1 circuits because a short-circuit in either would constitute a direct fire or life hazard. If B were shorted, the pilot tip control would open the gas valve supplying the main gas burner even when the pilot light was out. This would fill the area with explosive gas vapors. If D were shorted, the high limit control would not shut the unit down if a faulty thermostat failed to do so. This would permit the unit to reach unsafe temperatures and could result in a fire.

These circuits are required by Section 725-17 to be wired in conduit, EMT, or Type MI cable or otherwise suitably protected from damage. A short-circuit in any of the other labeled circuits would result in a safe failure of the unit. ("Normal" electrical hazards, as distinct from "direct" fire and life hazards, are, or should be, protected by proper overcurrent devices and wiring methods.)

1 I'm H. G. Millican, President of Millican Electric Company, Atlanta, Georgia. The people at SPANG asked me for my opinion of SPANG Conduit Couplings. We've used them for years—almost exclusively—on electrical jobs in our area, and there are a number of reasons why.

2 Most important from an installation viewpoint is the fact that the conduit will butt in the coupling—not just most of the time, but always. This butted joint leaves no slot for the snake wire to catch in. Makes wire pulling smooth. No time lost trying to unsnag hook ends.

3 SPANG quality is invariably high. Threads are clean and uniform—no burrs or snags to bind the conduit. In fact, you can run couplings on the conduit by hand. Practically a machine fit. Try it and see! It means the coupling is straight. This is another time-saver on the job.

4 SPANG Couplings are *double*-galvanized. First the conduit stock is hot-dipped — then the finished coupling is electro-galvanized. Now this means there is no metal-to-metal contact of coupling and conduit. No galvanic action. Instead, it forms a strong, watertight, permanent joint for excellent wiring protection.

5 Here's something else: the handy packaging SPANG uses for both its couplings and elbows. They're well-marked, easy to locate in storage and a snap to inventory. You know, the SPANG people say nobody produces a better coupling than they do. Know something else? They're right!

This is what one leading electrical contractor says about Spang Conduit Couplings

Thank you, Mr. Millican, for your comments on SPANG Conduit Couplings. Thousands of other electrical contractors share your enthusiasm for this top-quality SPANG electrical product.

The same top quality is the hallmark of all SPANG Conduit Products — SPANG HD Galvanized Conduit, SPANG Black Conduit, SPANGLEAM EMT and the new SPANG Rigid Aluminum Conduit. Your nearby SPANG Distributor carries the complete line. Call him for top-quality service!

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New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

CABLE "SERVICE ENTRANCE METALIC SHIELD"
WOOD MTD.

BASED ON 20 FT. PER SERVICE

SIZE NO. CONDRS.	HRS. "C" FT	LABOR COST PER FT. AT FOLLOWING RATES										
		$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
8/2	8.4	.168	.189	.21	.231	.252	.273	.294	.315	.336	.357	.378
6/2	9.5	.19	.214	.238	.261	.285	.309	.333	.356	.38	.404	.428
4/2	10.6	.212	.239	.265	.292	.318	.345	.371	.398	.424	.451	.477
8/3	9.8	.196	.221	.245	.27	.294	.319	.343	.368	.392	.417	.441
6/3	10.6	.212	.239	.265	.292	.318	.345	.371	.398	.424	.451	.477
4/3	13.3	.266	.299	.333	.366	.399	.432	.466	.499	.53	.57	.60
2/3	14.0	.28	.315	.35	.385	.42	.455	.49	.53	.56	.60	.63
		MASONRY MOUNTED										
8/2	9.5	.19	.214	.238	.261	.285	.309	.333	.356	.38	.404	.428
6/2	10.8	.216	.243	.27	.297	.324	.351	.378	.405	.432	.459	.486
4/2	12.1	.242	.272	.303	.333	.363	.393	.424	.454	.484	.51	.54
8/3	11.4	.228	.257	.285	.314	.342	.371	.399	.428	.456	.485	.51
6/3	12.3	.246	.277	.308	.338	.369	.40	.431	.461	.492	.52	.55
4/3	14.4	.288	.324	.36	.396	.432	.468	.50	.54	.58	.61	.65
2/3	16.1	.322	.362	.403	.443	.483	.52	.56	.60	.64	.68	.72

E-102-B

LABOR: INCLUDES STRIPPING CABLE, DRILLING ENTRANCE HOLE, INSTALLING CABLE AND STRAPPING.

10-60

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QUALITY-SERVICE

Insuring top quality of all CADWELD Electrical Connection installations is the policy at ERICO PRODUCTS, INC.

Twenty CADWELD FIELD ENGINEERS continually assist new customers sold by the distributors throughout the country.

Here, R. G. Smith, CADWELD Southeastern District Sales-manager, personally instructs a construction crew foreman in CADWELDING a grounding grid system for a southern electric utility.

For the best in electrical connections—specify Cadweld

CADWELD®

electrical connections

ERICO PRODUCTS, INC.

2070 E. 61st Place Cleveland 3, Ohio

Distributed in CANADA by

CLM Industries—Toronto 13, Canada

CAPPING CONDUIT WITH PENNIES AND BUSHING

CONDUIT SIZE	HOURS PER EA.	LABOR COST INSTALLED PER EA. @ FOLLOWING RATES										
		$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
1/2"	.15	.30	.338	.375	.413	.45	.488	.53	.56	.60	.64	.68
3/4"	.15	.30	.338	.375	.413	.45	.488	.53	.56	.60	.64	.68
1"	.15	.30	.338	.375	.413	.45	.488	.53	.56	.60	.64	.68
1 1/4"	.2	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
1 1/2"	.2	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
2"	.25	.50	.56	.63	.69	.75	.81	.88	.94	1.00	1.06	1.13
2 1/2"	.25	.50	.56	.63	.69	.75	.81	.88	.94	1.00	1.06	1.13
3"	.25	.50	.56	.63	.69	.75	.81	.88	.94	1.00	1.06	1.13
3 1/2"	.3	.60	.68	.75	.83	.90	.98	1.05	1.13	1.20	1.28	1.35
4"	.3	.60	.68	.75	.83	.90	.98	1.05	1.13	1.20	1.28	1.35

E-101-B

INCLUDES - LABOR TO PLACE PENNY AND SECURE BUSHING AND REMOVE AFTER ROUGH CONSTRUCTION IS COMPLETE.

10-60

CONDUIT IN WOOD WAREHOUSES

SURFACE MOUNTED — THIN WALL

COND. SIZE	HRS. PER "C" FT.	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
1/2"	5.8	.116	.131	.145	.16	.174	.189	.203	.218	.232	.247	.261
3/4"	6.2	.124	.14	.155	.171	.186	.202	.217	.233	.248	.264	.279
1"	6.4	.128	.144	.16	.176	.192	.208	.224	.24	.256	.272	.288
1 1/4"	9.9	.198	.223	.248	.272	.297	.322	.347	.371	.396	.421	.446
1 1/2"	12.4	.248	.279	.31	.341	.372	.403	.434	.465	.496	.53	.56
2"	15.8	.316	.356	.395	.435	.474	.51	.55	.59	.63	.67	.71
					RIGID							
1/2"	6.6	.132	.149	.165	.182	.198	.215	.231	.248	.264	.281	.297
3/4"	7.1	.142	.16	.178	.195	.213	.231	.249	.266	.284	.302	.32
1"	8.4	.168	.189	.21	.231	.252	.273	.294	.315	.336	.357	.378
1 1/4"	11.2	.224	.252	.28	.308	.336	.364	.392	.42	.448	.476	.50
1 1/2"	14.2	.284	.32	.355	.391	.426	.462	.497	.53	.57	.60	.64
2"	18.2	.364	.41	.455	.50	.55	.59	.64	.68	.73	.77	.82
2 1/2"	23.0	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
3"	30.2	.60	.68	.76	.83	.91	.98	1.06	1.13	1.21	1.28	1.36
4"	46.7	.93	1.05	1.17	1.28	1.40	1.52	1.63	1.75	1.87	1.98	2.10
5"	77.4	1.55	1.74	1.94	2.13	2.32	2.52	2.71	2.90	3.10	3.29	3.48
6"	109.1	2.18	2.45	2.73	3.00	3.27	3.55	3.82	4.09	4.36	4.64	4.91

E-101-B

LABOR: INCLUDES HANDLING MATERIAL AT SITE, DRILLING OR NOTCHING ACCESS HOLES, BENDING AND OFFSETS, INSTALLING ANCHORS, CUTTING, THREADING AND REAMING AND INSTALLING CONDUIT AND ATTACHING AT TERMINUS.

10-60

Electrical Estimating—III

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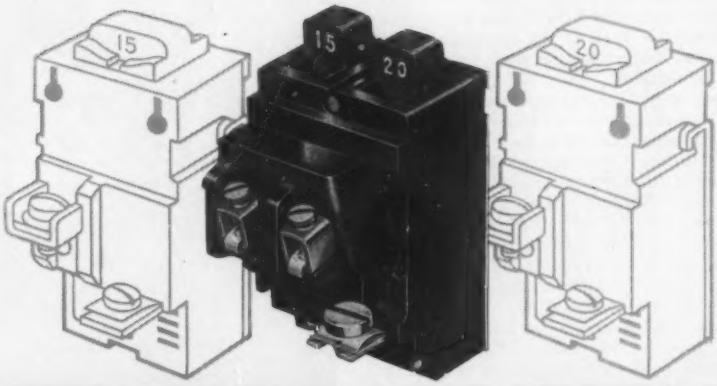
BULLDOG'S NEW

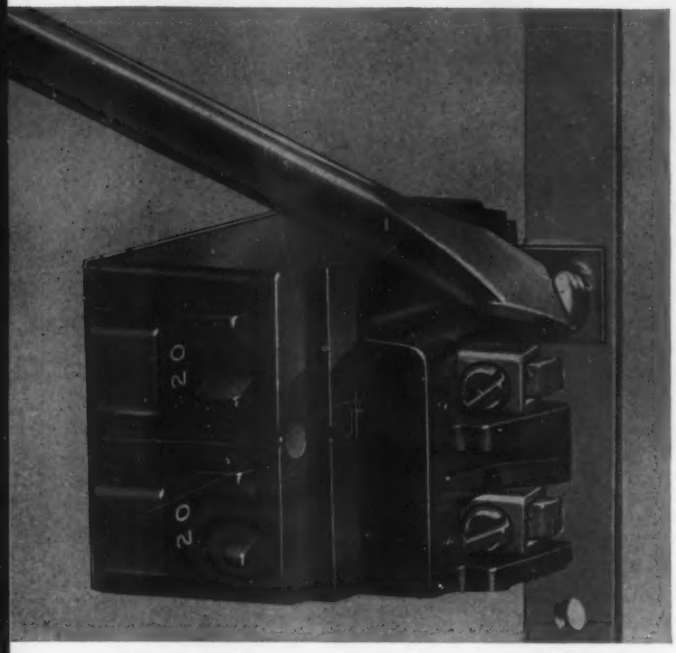
DUPLEX PUSHMATIC!

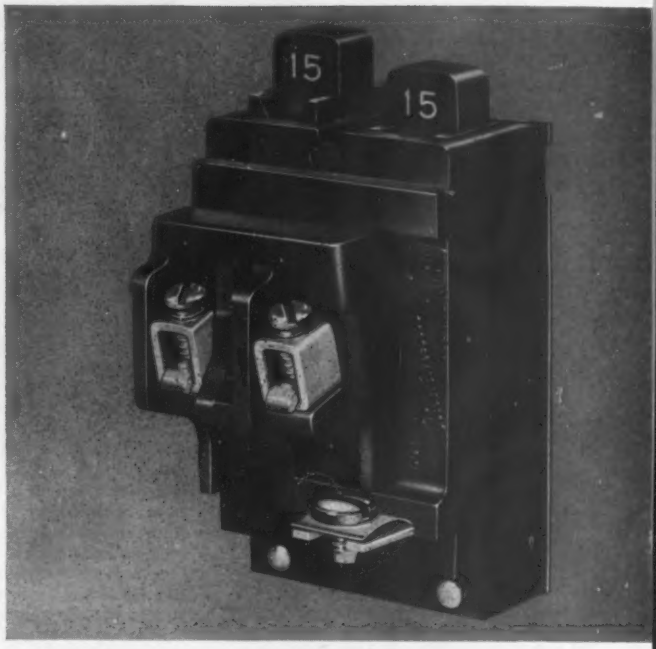
The space-saving breaker with true coil-magnetic protection!

1. SPACESAVER. New Duplex Pushmatic® breaker puts two breakers in the space of one single breaker. You get more electrical circuit flexibility with smaller panels; and 15- and 20-amp capacity, in any combination.

2. DOUBLE PROTECTION. Duplex is the only 2-in-1 breaker that gives coil-magnetic short-circuit protection, as well as thermal overload protection, for each circuit. Provides identical, independent coil protection in each pole.







3. ONE BOLTED CONNECTION. Duplex provides a single positive bolted connection to bus bar. Electrical contact is under constant pressure, won't work loose, won't overheat. Installation is quick and easy.

4. PUSHBUTTON CONVENIENCE. Only Duplex Pushmatic has pushbutton convenience. Pushbutton pops up, can be identified instantly by sight or touch. Reset it with a push of the finger. Simple, fast, foolproof!

See the new Duplex Pushmatic at the N. E. C. A. Convention, Booths 230, 231, 270, 271

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan.
In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
3210 Garrow St., P.O. Box 1725
Houston, Texas

Wilson Electrical Equipment Co.
101 E. Maple Street
San Antonio, Texas

Standard Electric Mfg. Company
2401 Federal St., P.O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N.W., P.O. Box 2308, Station D
Atlanta, Georgia

News of the industry

edited for Southern readers

Labor Board ruling on hiring hall regulation

Because of an alleged illegal hiring arrangement, a Jacksonville, Fla., electrical contractor and a union "local" have been ordered jointly to reimburse dues to the electrical contractor's electricians who worked at a Brunswick, Ga., industrial plant from February through July in 1958.

The contractor and the union also have been ordered to pay back wages to three electricians because of alleged discrimination.

The National Labor Relations Board issued the orders after it found that the contractor discharged two out-of-town electricians to make room for the local's members on its payroll and refused to hire a third electrician because he had not been referred by the local. The local, the Board said, actually, was referring only its own members, which was illegal.

The contractor had a contract with a Jacksonville local. When it went to Brunswick, the firm agreed to conform to the Brunswick local's contract. Under this contract, the Labor Board said, the latter ran an illegal closed shop, referring only union members for jobs and requiring discharge of out-of-town IBEW members when its own members needed work.

The Labor Board, in general, holds that for union hiring halls to be legal: (1) there should be no discrimination because of membership or non-membership in the union; (2) hiring hall regulations be conspicuously posted at the hall; (3) employers have the right to reject any prospective employee.

Lighting seminar work earns award for Hollis

AT GRADUATION exercises held recently for more than 100 students completing the 1960 Advanced Lighting Seminar, held in the auditorium of the Tampa Chamber of Commerce, Milton O. Hollis, executive vice-president, Raybro Electric Supplies, Inc., statewide distributor of electrical products, was cited for his interest and able assistance in making the first five seminars such an outstanding success.

The annual Advanced Lighting Seminar is jointly sponsored by the Lighting Department of Tampa Electric Co., the Florida Section of the Illuminating Engineering Society, and the Tampa Electrical Contractors Assn., featuring courses in general design, office and store lighting, residential lighting, luminous ceilings, ballasts, exterior lighting, and maintenance. Well-known experts in the field of lighting, including W. J. Pettyjohn, Jr., of Westinghouse Electric Corp., and R. G. Slauer of Sylvania Electric Products, Inc., and vice-president of the Illuminating Engineering Society, conducted the two-hour sessions throughout the well-attended seminars.

Mr. Hollis received a citation for his "untiring interest, assistance and cooperation" toward the success of the first five annual schools conducted for the purpose of furthering the cause of adequate illumination in the Tampa Bay area.

Milton O. Hollis (third from left) receives a citation for his interest and help in conducting the 1960 Advanced Lighting Seminar held recently in Tampa. Left to right are M. L. Harkey, General Electric Co., representing IES; Wallace Carothers, Carothers Electric Co., representing Florida Assoc. of Electrical Contractors; Mr. Hollis; and James A. Banton, Tampa Electric Co.

Public utilities hold conference in Tampa

THE 1960 REGION 5 Public Utilities Advertising Association Conference was held in Tampa, recently, with a theme of "The Job Ahead."

Some of the principal talks centered around methods and means of various types of publicity, ranging from radio and TV commercials to complete promotional campaigns.

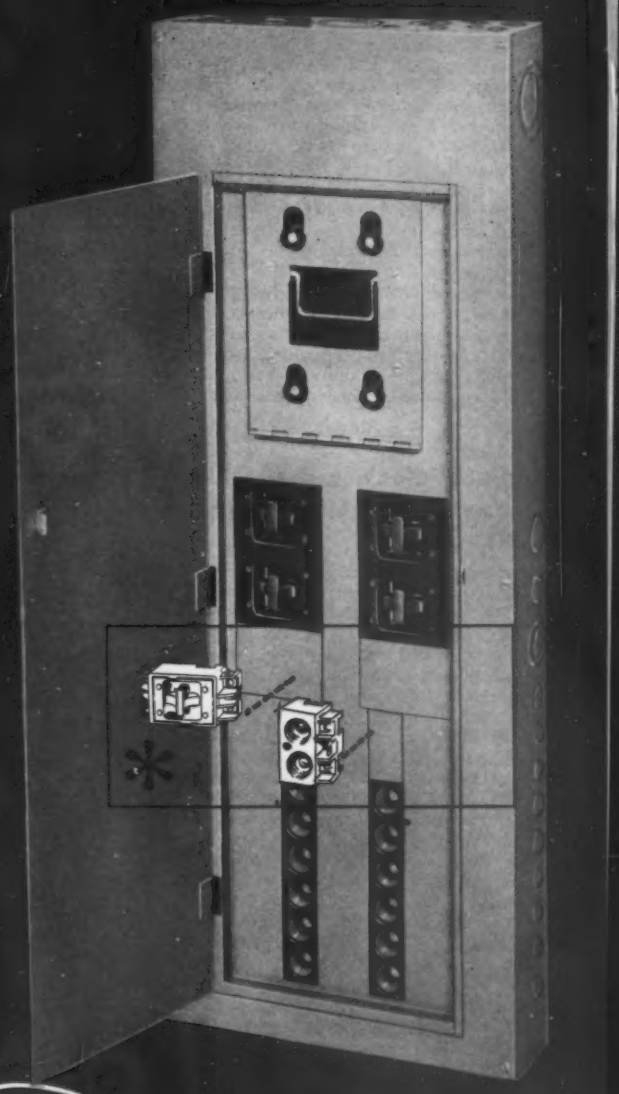
Included in the three day meeting were several reports on successful programs, as well as on future plans for utilities. The EEI's promotional plans were also discussed at the conference over which PUAA President Frank C. Leitz presided. The conference was called to order by Virgil S. Price, chairman of Region 5 and advertising manager of Tampa Electric Co.

Electric exposition planned for February

FLOOR PLANS for the 3rd Biennial Electrical Trade Conference and Exposition have gone into the mail to potential exhibitors for the 3-day event scheduled for February 14-16, 1961 at the Sheraton Park Hotel, Washington, D. C., according to show manager William G. Hills, managing director of the Electrical Institute of Washington.

NEW!

200-AMP ADD-ON* SERVICE Equipment



HINGED MAIN PULLOUT!

ARROW (AH) HART

FLEXIBLE and VERSATILE... All 200-amp "Add-On" pull-out and branch circuit units are interchangeable with A-H 100-amp "Add-On" units. Now you meet any customer's 200 amp electrical needs—present *or* future—with just one unit. This unit comes factory-assembled with a main 200-amp pullout, four 30- or 60-amp pullouts and twelve fused branch circuits . . . and you can add 1 or 2 pullouts and 2 or 4 branch circuits at any time with a maximum of 6 pullouts and 16 branch circuits. Exclusive hinged main pullout for convenience.

COMPACT ENCLOSURES . . . smaller than other comparable units, save space and make faster installations. The 14⅜" width allows mounting between studs.

FAST, EASY INSTALLATION . . . is insured by extra wiring space throughout the enclosure . . . including full 5" head space for incoming service lines. Ample knockouts are located adjacent to the branch circuits. Neutral terminal bars will accept wire sizes 4 to 14.

GET ALL THE FACTS. Write today for complete information. Department ES. The Arrow-Hart & Hegeman Electric Company, 103 Hawthorn St., Hartford 6, Conn.

STOCK AVAILABLE FROM OUR ATLANTA WAREHOUSE

ARROW (AH) HART

Quality since 1890

ENCLOSED SWITCHES • WIRING DEVICES
MOTOR CONTROLS • APPLIANCE SWITCHES

The Electrical Trade Conference will be under the joint sponsorship of the Electric Institute of Washington and the Electrical Manufacturers Representatives Association of Baltimore. Space sales will be handled by the Electric Institute of Washington.

Exhibits will be limited primarily to industrial electronic equipment; controls, motors, motor drives; heavy panel boards; commercial and industrial lighting; electric space heating; safety devices and allied equipment.

National industry trade groups and engineering organizations will be invited to attend regularly scheduled meetings in Washington during the three days of the trade show.

Rural electric leaders convene in Mississippi

E. L. PHILLIPS was elected president of the Mississippi Rural Electric Association recently, as more than 200 rural electrification leaders from throughout the state met in Jackson to hear and discuss plans and reports of progress in various projects now underway by the group.

Mr. Phillips represents the Capital Electric Co. Also elected were R. V. Taylor, Natchez Trace Electric, vice-president; and L. R. Parker, Yazoo Valley Electric, secretary-treasurer.

Present at the meeting were members, officers, employees, and boards of directors of most of the 26 electrical power associations in Mississippi.

Keynote speaker for the occasion was R. D. Morrow, of Brandon, president of South Mississippi Electric Power Assn. This association is comprised of nine rural electric systems which are pooling resources for the purpose of constructing a new $16,000,000 plant for generation and transmission of electric power.

Mr. Morrow talked about the program, and increased standard of living in rural areas, which has been a direct result of rural electrification.

Western Section IAEI to meet in Missouri

THE 56TH ANNUAL Western Section IAEI Convention, to be held in Kansas City, Mo., has been slated for October 3-5, 1960, it was announced recently by David M. Lines, secretary and treasurer for the organization.

The program will include an address by International President P. L. Hicks, Jr., another address by Western Section President W. E. Stewart, and other speakers on the subjects of "Inspection and What It Accomplishes," "New Products in Aluminum," "Inspector's Training," and "Mobile Homes and Coaches." There will also be a panel discussion of the electrical Code.

MacDonald named to head Potomac Edison Company

R. G. MACDONALD of Greensburg, Pa., has been elected president of the Potomac Edison Co., Hagerstown, Md. His election followed the resignation of former President D. E. Stultz, whose activities have been restricted by ill health since the first of this year. Mr. MacDonald has been vice-president-marketing of the West Penn Power Company since 1955. Both companies are in the West Penn Electric System.

Mr. MacDonald is an electrical engineering graduate of the University of Pittsburgh, and has been with West Penn Power for over 29 years. In the past he had charge of sales, promotion, and development activities, including commercial, industrial, municipal, residential, and farm markets. In addition, his responsibilities included area development, public relations, and advertising.

R. G. MacDonald

He has served as chairman of the Edison Electric Institute Residential Group, a member of the EEI Sales Division Executive Committee, and a member of the EEI Awards Committee; a member of the Pennsylvania Industrial Development Authority Board; and Chairman of the United Fund of Central Westmoreland.

He is currently chairman of the EEI Sales Division Executive Committee, and a member of the Sales Executives Conference and the Illuminating Engineering Society.

Westinghouse launches fall marketing program

THE MOST EXTENSIVE and aggressive marketing program in the history of the Westinghouse lamp division will be launched by the company this fall.

According to Charles E. Erb, general marketing manager for the division, the broad program will encompass some of the most dramatic light bulb packaging changes ever undertaken by the industry; entirely new products in practically all major product lines; an extensive advertising campaign, including nation-wide election coverage on TV; ads in national magazines and newspapers; an entirely new program for providing industry and commerce with some of the greatest possible economy in lighting; and a fresh approach to merchandisers and displays used at the point of sale.

Mr. Erb said that in the weeks ahead Westinghouse would disclose each of its major new marketing programs in detail. Speaking before a series of meetings of lamp division region sales managers held across the nation, Mr. Erb revealed that the company had employed the services of one of the world's leading graphic designers to completely restyle the packaging for all of its major lines of household light bulbs, both standard and premium types. These designs have been completed and preparations are under way to begin printing the new packages.

It was also disclosed by Mr. Erb that Westinghouse will shortly unveil a new concept in fluorescent lamp efficiency which the company expects will have a major impact on the commercial, and particularly, the industrial market.

Truco and Clute merge to expand both firms

E. V. GARNETT, president of Truco/Denver, recently announced an expansion program into research, development, engineering and manufacturing through a merger of Truck Equipment Company with the Clute Corporation, also of Denver.

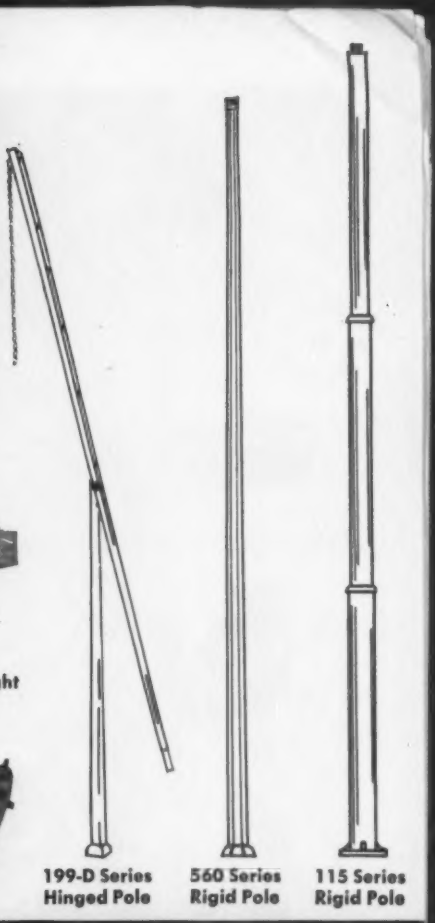
"This move will enable Truco to expand its engineering and design into new equipment and new applications," Mr. Garnett said. "Additional capital will make possible penetration into other markets and industries with new material and personnel handling equipment. Our truck mounted aerial equipment and trailers are now used extensively in the fire, railroad and utilities industries and Truco products are exported to a wide group of countries in the free world."

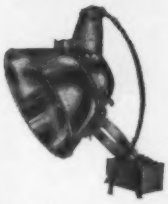
In this move to strengthen its engineering, manufacturing and financial position, Truco will become a division of the Clute Corporation. Clute manufactures air equipment used in the separation and movement of grains, minerals, seed and other commodities.

San Antonio group hears Killark representative

WENDEL SCHINDLER, representative of the Killark Electric Manufacturing Co., St. Louis, was featured speaker recently at a San Antonio meeting of electrical contractors, engineers, wholesalers, and salesmen.

Mr. Schindler discussed Killark





2000 Series Floodlight

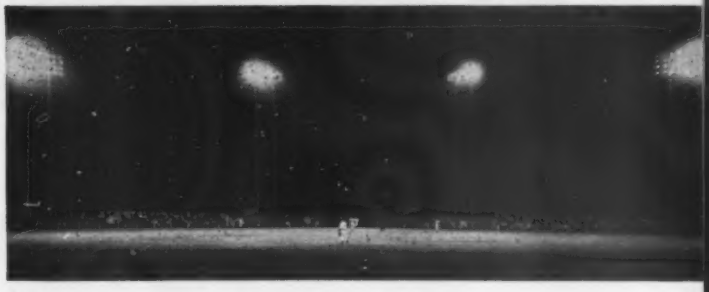
3800 Series Floodlight

4200 Series Floodlight

199-D Series Hinged Pole

560 Series Rigid Pole

115 Series Rigid Pole



Revere's wide line of fixtures lets you light sports areas the one best way for each job

You don't have to shop around for components required to light outdoor sports areas the one best way for each application. Just plan your work the way you know the job should be done, then call on your Revere wholesaler. Whatever outdoor lighting equipment your plans call for, he can supply it from Revere's complete line, without substituting components which may be less than best for the job.

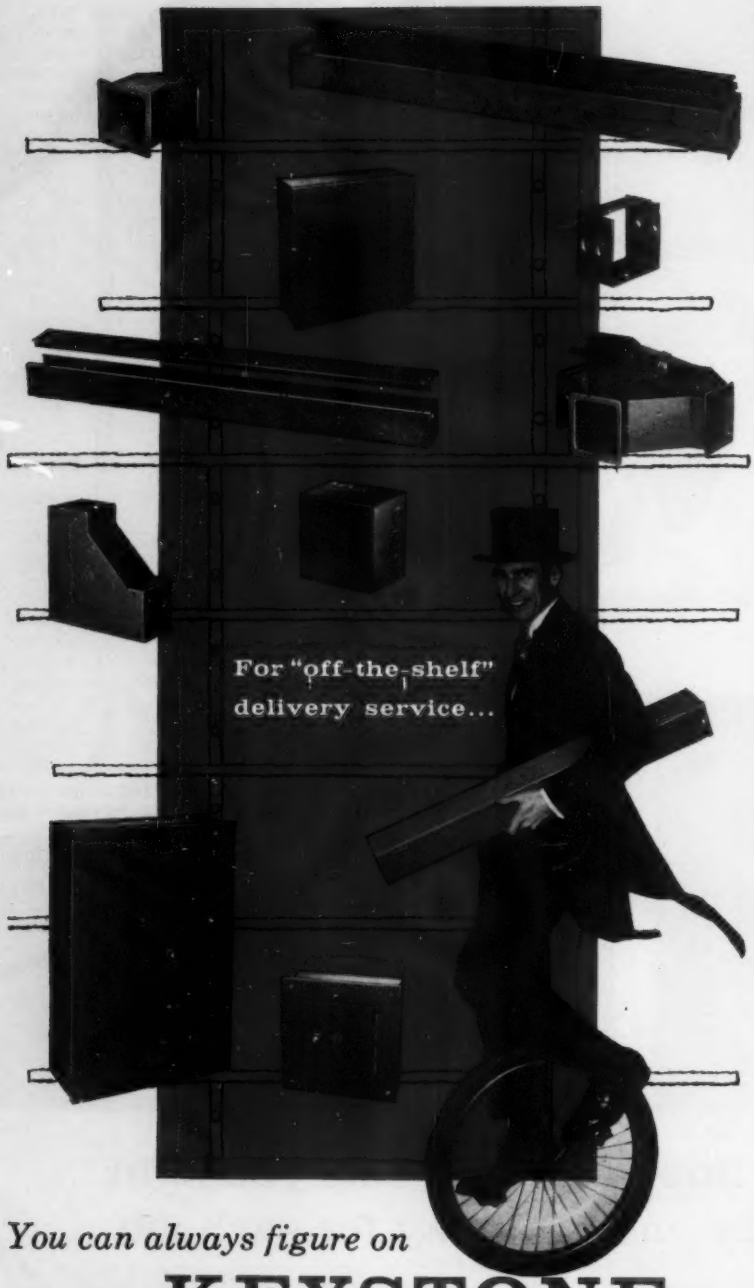
Whether you need hinged or rigid poles . . . mercury, incandescent or fluorescent luminaires . . . floodlights, fixtures and fittings—Revere has them all, *structurally* matched for strength, balance and perfect fit; *design* matched for peak lighting efficiency and best appearance. Installation is fast, easy, trouble-free.

Ordering all equipment from your Revere wholesaler simplifies paperwork and assures delivery of all components to your job site according to your construction schedule. See him about Revere fixtures for your next job. Write to us for a catalog showing Revere's complete line of outdoor lighting equipment.

Revere ELECTRIC MFG CO.

OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario



You can always figure on

KEYSTONE

Wherever you are, whatever you want—Keystone has a complete line of quality wiring installation equipment ready for *immediate* delivery! Coast-to-coast warehouses stock all sizes, shapes and types of U.L. listed wireways and auxiliary fittings, cabinets, boxes and enclosures—J.I.C. equipment, too. So, for prompt service all ways—you'll find it always . . . *pays to figure on Keystone.*

KEYSTONE MANUFACTURING CO.
Division of AVIS INDUSTRIAL CORPORATION
23333 Sherwood Avenue • Warren, Michigan

panels and breakers during the session, which was sponsored by the George E. Anderson Co., Southwestern sales agent of electrical manufacturers. The Anderson company is located in Dallas, Texas.

Electrical Wholesalers opens Atlanta branch

A NEW BUCKHEAD branch of Electrical Wholesalers, Inc., was recently opened in Atlanta, Ga., Fred H. Dendy, Jr., president of the firm, has announced.

Located at 210 Pharr Rd., N.E., Atlanta, this is the first Atlanta branch venture for the company. The main

Mrs. Maureen Lane, lighting consultant, and Don C. Martin, manager of Electrical Wholesalers' new Buckhead branch, examine a portion of 300 fixtures on display.

house operation of the company is located in downtown Atlanta, where it has remained for 24 years of operation.

Don C. Martin has been appointed manager of the new branch. Mr. Martin has had more than five years of diversified experience in the wholesale electrical supply and lighting field in Atlanta. He will be assisted by John Skinner, warehouse manager.

Featured in the branch is a lighting fixture and kitchen appliance display room, where more than 300 residential and commercial fixtures are displayed, along with kitchen appliances.

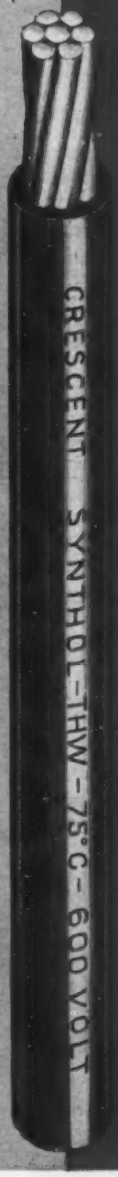
Brief news notes of manufacturers

PRODUCTION of their new bituminous fiber conduit has now begun, it was announced recently by Triangle Conduit & Cable Co., Inc. The development places Triangle in the

CRESCENT

SYNTHOL BUILDING WIRE

TYPE-THW-75° C



for WET or DRY LOCATIONS

Type THW permits greater current carrying capacity than Type TW while retaining the advantages of smaller diameter, smooth, lubricated easy-pulling surface with solid colors. Resistant to water, acid, alkali, oil and corrosive atmospheres, it is inherently flame-retarding. It will give the lowest installed cost per ampere. Particularly advantageous for replacing overloaded feeders, as its smaller diameter makes possible greater current carrying capacity in the same size conduit.

CRESCENT INSULATED WIRE & CABLE CO., INC.

OVER 75 YEARS EXPERIENCE

TRENTON, NEW JERSEY

position of offering one of the most complete lines of conduit in the electrical industry.

Fiber conduit production will take place at the company's 210,000 square feet plant at Landisville, N. J. The new plant is one of the most modern and fully automated fiber conduit plants in the world. Tremendous production capacity and highly controlled quality are expected, Triangle officials say.

* * *

I-T-E Circuit Breaker Co., Philadelphia, has acquired all the outstanding capital stock of Standard Electric Manufacturing Company of Dallas, Texas. The firm was purchased from R. Porter Lindsley, Jr., sole owner who has functioned for a number of years as president and general manager. He will remain as president and general manager and other officers will continue in their former positions.

Standard is an assembler of lighting and power switchboards. It has been for some time a sales representative in northern Texas, northwest Arkansas and Oklahoma for the products of I-T-E's BullDog division.

* * *

Demonstrations capped the first showing of Line Material Industries' recently constructed high voltage research laboratory. Tests on a 1,500,000-volt surge generator and 700,000-volt power frequency test equipment were conducted before company officials and visiting utility personnel.

This new laboratory is the latest step in the expansion of L-M's 134-acre Thomas A. Edison research and engineering center at Franksville, Wis. According to R. G. Wheaton, president, the laboratory was designed to meet future industry needs. The surge generator and the 60-cycle equipment have three times greater capacity than the company's South Milwaukee facilities. The new laboratory does not replace existing facilities, but supplements their test programs.

* * *

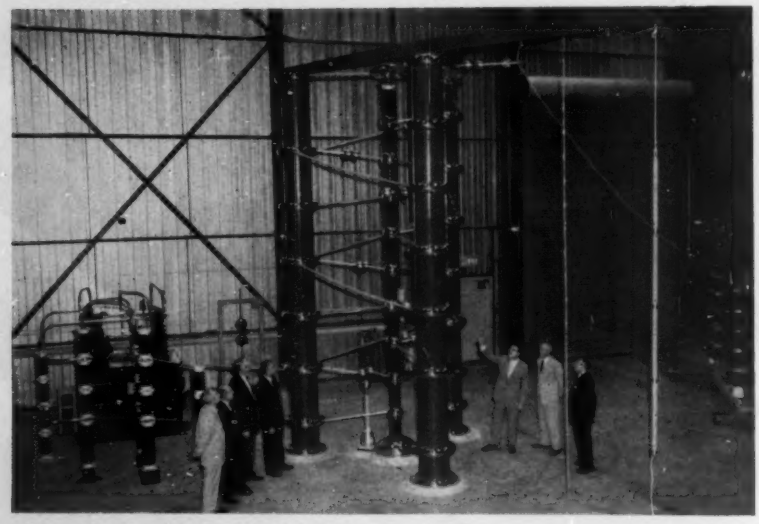
Thomas Industries, Inc., Louisville, Ky., manufacturers of residential, commercial and industrial lighting fixtures, power saws, paint sprayers, and other products, has announced that it has centralized all engineering functions under a new administrative department as part of plans for "future growth and expansion." Named to the new post of director of engineering was Frank J. Marriett, previously chief engineer of the Benjamin division of Thomas Industries at Des Plaines, Ill.

Engineering functions of the four major divisions of the company, including Benjamin, Moe Light, Electric Sprayit and Wright Saw, previously reported to the merchandising department with headquarters in Louisville.

* * *

A new department charged with furnishing up-to-the-minute technical product information to customers, anticipating changing product requirements and furthering the training of its sales force has been established by Jefferson Electric Co., Bellwood, Ill. The announcement of the new Technical Services Department was made by Bertrand J. Farrell, general sales manager for Jefferson. Joseph A. Schneller, former marketing manager of Quadrangle Manufacturing Co., Chicago, has been named to manage the new unit.

Gedney Electric Company and Andrew Terry Company have jointly announced their recent consolidation. The new corporation formed as a result of the consolidation is Gedney Electric Co., Inc., with capital assets exceeding $1,800,000.



Above is a portion of Line Material Industries' recently completed high voltage research laboratory at Franksville, Wis., near Milwaukee.

Dates ahead

American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill., Oct. 9-14, 1960.

National Rural Electric Cooperative Assn., Region II, Annual Meeting, Henry Grady Hotel, Atlanta, Ga., Oct. 10-11, 1960.

Florida Assn. of Electrical Contractors, Annual Convention and Electric Show, Deauville Hotel, Miami Beach, Fla., Oct. 12-15, 1960.

National Rural Electric Cooperative Assn., Region IV, Annual Meeting, Stonewall Jackson Hotel, Clarksburg, W. Va., Oct. 13-14, 1960.

National Rural Electric Cooperative Assn., Region X, Annual Meeting, Baker Hotel, Dallas, Texas, Oct. 17-18, 1960.

IAEI, Southern Section, Rice Hotel, Houston, Texas, Oct. 17-19, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Shoreham Hotel, Washington, D. C., Oct. 20-21, 1960.

Power Industry Computer Application, 2nd National Conference, Chase Hotel, St. Louis, Mo., Nov. 9-11, 1960.

Southeastern Electric Exchange, Sales Conference, Henry Grady Hotel, Atlanta, Ga., Nov. 16-18, 1960.

Missouri Valley Electric Assn., Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 9-10, 1961.

Missouri Valley Electric Assn., Engineering Conference, President Hotel and Municipal Auditorium, Kansas City, Mo., April 12-14, 1961.

Alabama Electrical and Electronics Exposition, Second Annual Exposition, Birmingham City Auditorium Convention Hall, Birmingham, Ala., April 17-19, 1961.

News about people

The promotion of **C. A. Gunn** to government sales manager of the Wire and Cable Division of Copperweld Steel Company was recently announced by **George Hamburger,** manager of sales for the Wire and Cable Division of the company.

With headquarters at 140 S. Dearborn St., Chicago, Ill., Mr. Gunn will

C. A. Gunn

coordinate wire and cable sales to federal government agencies throughout the United States.

Prior to joining Copperweld in 1959, he served as industrial sales manager of Kellogg Switchboard and Supply Co. He attended the Rice Institute and the University of Texas, receiving a B.S. degree in electrical engineering in 1948.

Ward Leonard Electric Co., Mount Vernon, N. Y., announces the appointment of **Ray W. Lunstead** as manager of the company's Electronic Distributor Div. He succeeds **Ken Hathaway** who has retired. Distributor headquarters, formerly in Chicago, Ill., will now be located in Mount Vernon, N. Y. Mr. Lunstead joined Ward Leonard in 1941.

The Holan Corporation of Georgia recently announced the appointment of **Peter A. Sandford** as district manager for the Georgia, Tennessee, Louisiana, and Arkansas territory.

Mr. Sandford is an electrical engineer, and served with the cook Electric Company and Automatic Electric Sales Corporation prior to his new position.

R. R. Rector, vice-president and general manager of Holan, made the announcement.

The appointment of **Walter Barnes** as Southeastern sales manager of Wheatland Electric Products Co. has been announced by Wheatland President **R. C. Bennett, Jr.** For the past

Walter Barnes

fifteen years, until July 1960, Mr. Barnes had been manager of National Electric Products Corp., Southeastern Region. He will have direct charge of Wheatland's sales in Georgia, North and South Carolina, East Tennessee and Alabama, with supervision of the company's agents in Florida, Hopper & James.

Southern States has made three sales department appointments: **Phillip Williams** has been named Southeast regional manager and will cover Florida, Kentucky, Alabama, and portions of Georgia, Louisiana and Mississippi; **John Howell** has been named regional manager covering South Carolina, North Carolina, and portions of Georgia; **Thomas Ellison** has been named regional manager for West Virginia, Virginia, Tennessee, Pennsylvania, Delaware, Maryland, District of Columbia, and portions of Mississippi and New Jersey.

R. Courtenay Bythewood, of 2390 Glendale Drive, Decatur, field supervisor for the Georgia Power Company's residential sales engineering division for the past two years, has been named the division's manager. He succeeds the late **Morris T. Reeves.**

R. C. Bythewood

A native of Fairfield, Alabama, Mr. Bythewood holds the degree of bachelor of science in electrical engineering from Georgia Tech.

A registered professional engineer, Mr. Bythewood is a member of the Georgia Society of Professional Engineers. In addition to having served on the Society's board of directors, he also has been secretary and treasurer of its Atlanta chapter. He also is a member of the Georgia Engineering Society and the Illuminating Engineering Society.

The appointment of **S. T. (Wally) Walz** as Southeastern region manager of the Square D Company has been announced by **M. P. Kartalia,** Square D's marketing vice-president. In this

S. T. Walz

new capacity, Mr. Walz directs the manufacturing operations of Square D's Atlanta assembly plant as well as heading up all Southeastern marketing activities.

This latest promotion for Mr. Walz is one of many since he joined Square D as assistant to Detroit sales manager in 1934, after getting his BS degree at Michigan College of Mining & Technology.

Leonard Murrans has been appointed sales manager of the South-

Leonard Murrans

eastern region, reporting to Mr. Walz. Murrans joined Square D in 1949 and comes to Atlanta from Charlotte, N. C., where he has served as manager since 1957.

EASIER TO DO... and costs less too!

B-M

INDENTER FITTINGS and TOOLS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.

Red Throat
BM-21B
½" Connector

Red Throat
BM-22B
¾" Connector

Red Throat
BM-23B
1" Connector

BM-41
½" Coupling

BM-42
¾" Coupling

BM-43
1" Coupling

BM-51
½" Offset Connector

BM-21
½" Connector

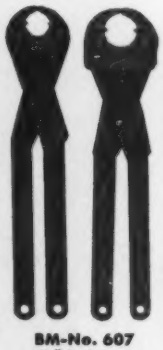
BM-22
¾" Connector

BM-23
1" Connector

BM-No. 600
Changeable Jaw Indenter

BM-No. 1000
Handvise for ½", ¾" and 1" E. M. T.

BM-No. 100
Cutter for ½", ¾" and 1" E. M. T.



BM-No. 607
½" Indenter
BM-No. 608
¾" Indenter

UL

TELESCOPE BM SYSTEM

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

ACTUAL TESTS* PROVE

Allen-Bradley Standard Duty Push Buttons can be installed

in about half the time!

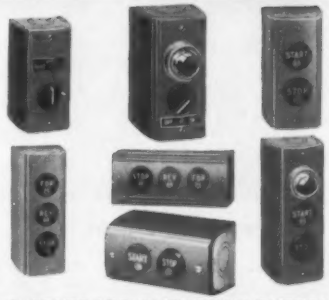
In accurately timed tests, Allen-Bradley standard duty push buttons required *about half the installation time*—on the average—than each of four other popular makes. This saving in installation time means "dollars" saved on the job.

How come only famous A-B standard duty push buttons possess this time and moneysaving advantage?

The answer lies in the molded, wrap-around cover—which also contains the contacts. When the cover is removed, the wiring terminals are *out in the open*—ready for wiring—and you have plenty of working space. The two cover screws are captive—they cannot fall out and get lost. And with the contacts in the cover, they are protected against accidental damage and careless wiring. Naturally, these push buttons have double break, silver contacts that never need service attention. There are two concentric knockouts on each end of the base, which are removed from the *outside*—the heavy, pressed steel base will not bend out of shape.

Your local A-B distributor has these Bulletin 800 push buttons *in stock.* Call him today—you'll save time and money on your next job.

**Using recognized standard duty push buttons, installations were made by an experienced electrician under identical conditions. He was not connected with Allen-Bradley Company in any manner.*



A-B STANDARD DUTY PUSH BUTTONS
Made as a one-, two-, or three-unit station—with pilot light available. Readily changed for horizontal or vertical mounting. Convertible two- or three-way selector switch supplied with or without pilot light.

ALLEN-BRADLEY Member of NEMA — **Quality Motor Control**

Allen-Bradley Co., 1305 S. First St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

CONSULT YOUR LOCAL ALLEN-BRADLEY REPRESENTATIVE

ATLANTA—Roy E. Wilson Co., 1062 Northside Drive, N. W., Tel: TRinity 6-8833
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BIRMINGHAM—J. L. Howarth Co., Inc., 825 S. 22nd St., Tel: FAirfax 3-1171
CHARLESTON—Henry E. Payne, 918 Kanawha Blvd., E., Tel: DIckens 3-1393
CHARLOTTE—LeRoy P. Spoon, 307 Lincoln St., Tel: EDison 4-6334
DALLAS—John F. Rasco, 2810 McKinney Ave., Tel: TAylor 3-6179
HOUSTON—Allen-Bradley Co., 2105 McKinney Ave., Tel: CApitol 5-0747
JACKSONVILLE—Van & Smith Co., Inc., 1446 June St., Tel: EXbrook 8-0531
KANSAS CITY—B. L. McCreary & Son, 1819 Central St., Tel: HArrison 1-1668
KNOXVILLE—Bowditch & Co., 1311-C N. Broadway, P. O. Box 3145, Tel: 4-2513
LITTLE ROCK—Curtis H. Stout, Inc., 400 Shall St., P. O. Box 107, Tel: FRanklin 4-8201
LOUISVILLE—The Rietze Company, 2209 S. Floyd St., Tel: MElrose 7-3603
MEMPHIS—Curtis H. Stout of Tennessee, Inc., 718 M & M Bldg., Tel: JAckson 6-7601
MIAMI—Charles R. Lee & Assoc., Inc., 3796 W. Flagler St., Tel: Highland 4-7414
NEW ORLEANS—Robbins & Robbins, 1037 Magazine St., Tel: JAckson 2-5805
ST. LOUIS—Allen-Bradley Co., 904 N. Grand Blvd., Tel: JEfferson 5-1901
TAMPA—Van & Smith Co., Inc., 4025 Henderson Blvd., Tel: 8-3632
TULSA—John W. Elder Co., 1526 East Fourth St., Tel: Diamond 3-9149

Announced recently was the addition of two more sales representatives to the Virden Lighting sales organization. They are **Walter C. Stadler** and **James O. Knight.** Mr.

Walter C. Stadler

Stadler will represent Virden in the Dallas and Northeast Texas area; Mr. Knight in the Fort Worth, North and West Texas area.

Mr. Stadler has been associated with the electrical trade for 12 years, ten as a distributor salesman and two as sales representative for Lighting Dynamics Inc., Dallas.

Mr. Knight is a seven-year veteran

James O. Knight

of the industry. He has served in several capacities with Texas Electric Service Co., including that of lighting advisor and later as a sales representative with Lighting Dynamics.

William E. Mitchell, former president of the Georgia Power Co., died at his home in Atlanta recently at the age of 78. He had been in ill health for several months.

A graduate of the Massachusetts Institute of Technology, Mr. Mitchell served two years with General Electric Co., then went to Brazil to work on the construction of several large electrical developments. Later he joined the Alabama Power Co.

In 1927, he became associated with Georgia Power Co., as vice-president and general manager. In 1945 he was elected president, serving until 1947.

During his retirement years, Mr. Mitchell served as head of the industrial division of the Economic Cooperative Administration in France, one of the most important positions in the Marshall Plan program.

Willard J. McLachlan has been named manager of a newly-established electric utility systems engineering operation in the Electric Utility Engineering Operation of General Electric.

In announcing the appointment, **James F. Young,** general manager of EUEO, said that headquarters of Mr. McLachlan's operation would be in Schenectady.

Mr. McLachlan also will serve as acting manager of the Electric Utility Analytical Engineering Operation. He has been Manager of the Electric Utility Engineering Section of User Industries Sales in the Apparatus Sales Div., prior to his new appointment. He is a graduate of Washington State College.

Gerald A. Petersen, president of Petersen Engineering Co., Inc., of Santa Clara, Calif., presented a short talk on tension stringing methods of line construction to power system engineers from more than 50 countries at the recent International Conference of Large Electric Systems (CIGRE) in Paris.

Gerald A. Petersen

He was accompanied by **J. T. Isbell,** vice-president in charge of sales for Petersen Engineering Co. A traveling companion on the SAS inaugural DC8 trans-polar flight was **Ake Rusck,** former president of the Swedish Power Board and Swedish delegate to CIGRE for many years prior to his present position as president of Scandinavian Airlines System.

Technical books

for the electrical man

Code guidebook

"National Electrical Code Handbook," (based on the 1959 edition of the National Electrical Code) revised by Frank Stetka, electrical field service engineer, National Fire Protection Assn. Published by McGraw-Hill Book Co., Inc., 327 West 41st St., New York 36, N. Y.; tenth edition; 679 pages, 387 illustrations, 53 tables; $8.50.

Facts on how to handle all types of electrical wiring and installation jobs in strict accordance with the latest National Electrical Code are presented in this newly-published edition of a well-known handbook. It explains rules and measurements for electrical jobs, what they mean, and how to apply them. The book follows exactly the same numbering system as presented in the code, providing easy reference to any rule. Next to the rule, in a contrasting typeface for ease of reference, is found its meaning, intent, and interpretation where applicable.

Important new features in the tenth edition include reorganization in line with the rearrangement and renumbering of the National Electrical Code, and numerous important changes in basic requirements. The Handbook also gives modern examples of how to calculate electrical load, number of branch circuits, and size of feeders.

Using an oscilloscope

"101 More Ways to Use Your Scope in TV," by Bob Middleton. Published by Howard W. Sams & Co., Inc., 1720 East 38th St. Indianapolis 6, Ind., 160 pages, $2.50.

For each of the 101 oscilloscope uses described in this volume, the author lists the equipment needed (in addition to an oscilloscope), connections required, test procedure, and an evaluation of the test results. Special notes give supplementary information. Waveforms and test setups are shown for each test and for many of the notes. All of the uses shown in "101 More Ways to Use Your Oscilloscope" are new and different . . . none are duplicated in previous volumes of the series.

Like the first companion volume ("101 Ways to Use Your Oscilloscope"), the newer publication stresses the proper interpretation of observed waveforms.

Typical sections included in the book are tests for: equipment, RF- and IF-amplifiers; video-amplifiers; AGC; intercarrier sound; sync-separators; vertical-sweep circuit; horizontal-AFC and-oscillators; horizontal-sweep, etc.

Ultrasonic applications

"Ultrasonics," by Benson Carlin, executive vice-president, Ciro Ultrasonic Corp. Published by McGraw-Hill Book Co., Inc., 327 West 41st St., New York 36, N. Y., second edition, 350 pages, 263 illustrations, $11.50.

Slanted toward practical engineering design and industrial applications, this book covers theory and methods of generating waves, outlines circuits and other considerations, and discusses mechanical and electrical design of systems. It treats every important phase from the design consideration of ultrasonic crystals to the experimental measurement of ultrasonic waves in various media, and includes data on instruments and applications.

This revised second edition covers new developments in the testing of materials, cleaning, welding, soldering, medical, and other applications. It includes new advances in the design of generators, transducers, transducer tools and joinings, and on means of testing equipment.

The book explains changes in the form of matter brought about by ultrasonic agitation in the chemical, physical, and biological fields, and describes characteristics of ultrasonic waves important in practical applications.

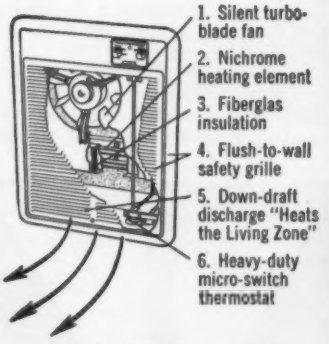
Among the many specific topics covered are waves of dilation; the beam spread at various frequencies from a given transducer size; possible ways of producing ultrasonic waves; and different types of electromechanical converting systems.

Zener diode handbook

"Technical Handbook for Engineers," published by International Rectifier Corp., El Segundo, Calif., 100 pages, $2.00.

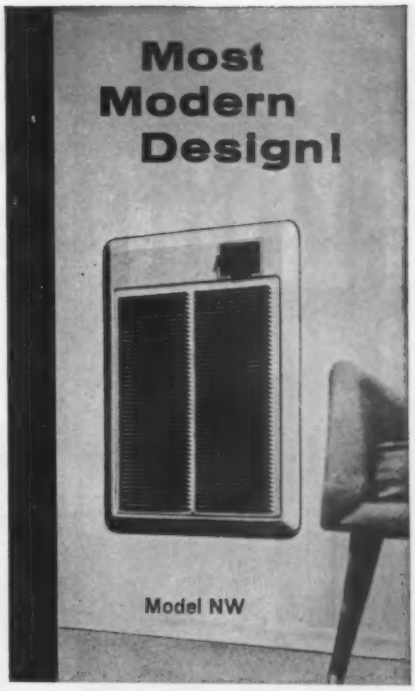
A study of zener diodes and zener reference elements is prefaced by an introduction to semiconductor theory and reverse breakdown, and followed with a detailed and illustrated examination of design considerations, thermal and operating characteristics, and discussions of zener diode: a-c applications; d-c applications; Audio and RF applications; computer and instrumentation applications, and circuit protection applications.

Most Efficient Heating!


1. Silent turbo-blade fan
2. Nichrome heating element
3. Fiberglas insulation
4. Flush-to-wall safety grille
5. Down-draft discharge "Heats the Living Zone"
6. Heavy-duty micro-switch thermostat

Master Duty Model NW
—the fastest "living zone" heater

Most Modern Design!



THERMADOR
Bilt-In Electric Heaters

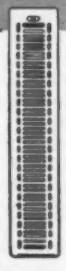
Millions in use

Master Duty Fan-type Model NW (shown above) is designed for flush-to-wall installation between standard 16" O. C. studding, without extra framing. Quiet, powerful turbo-blade fan directs heated air downward, to circulate thru the "Living Zone" of the room. No waste concentration of heated air at the ceiling.

Thermador Model NW has the *greatest heat speed of any heater.* Fast-heating nichrome wire—no heavy castings to pre-heat. Element recessed for safety. Residual heat expelled so efficiently, heater is UL approved for top wiring. Convenient top switches, neon indicator light, and safety thermo-cutout. Manual or thermostat models. Serves as an air-circulator in summer.

Spanish Gold baked enamel finish, or can be painted to match decor. 2000 to 4500 watts output, 240 volts A.C. From 6824 to 15,354 BTU's per hour. Overall grille size: 21" high x 16¾" wide. Projects 15/16" from wall to edge of louver.

Complete line for all applications:
Model LR Full-length radiant
Model NB Medium-wattage fan-type
Model CH-121 Ceiling fan-type
Baseboard heater, 30⅜" to 121¼"
Model RB Radiant space-saver



Originator of the Fan-Type Bilt-In Electric Heater

THERMADOR Electrical Manufacturing Co.

Division of Norris-Thermador Corporation

"Space Leagues Ahead"

5119 District Blvd., Los Angeles 22, Calif. Dept. 424

Please send me illustrated literature on Thermador Electric Heaters.

☐ Architect ☐ Electrical Contractor ☐ Builder

☐ Wholesaler ☐ Dealer ☐ Other_____

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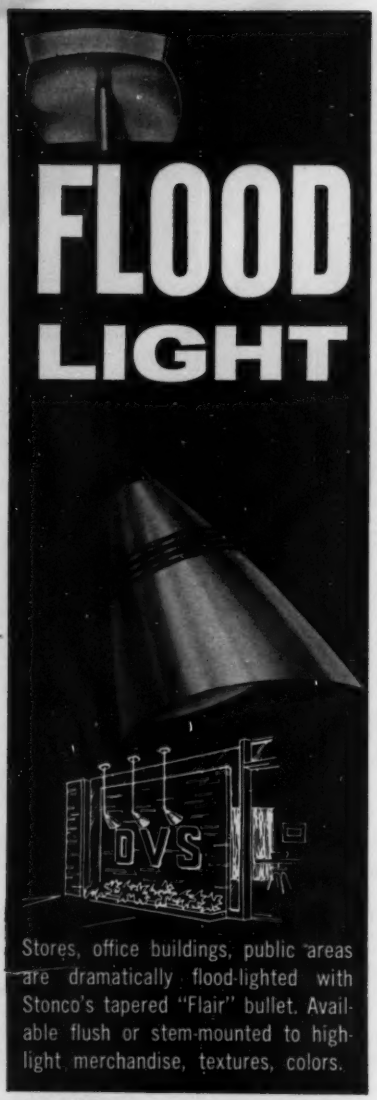
ADDRESS_____

CITY_____ COUNTY_____ STATE_____



Stores, office buildings, public areas are dramatically flood-lighted with Stonco's tapered "Flair" bullet. Available flush or stem-mounted to highlight merchandise, textures, colors.

STONCO cast aluminum outdoor bullets!

Don't let the styling of Stonco's new "Award Series" fool you. These are outdoor bullets. Solid cast aluminum. Completely weatherproof. "Air-Conditioned" for cooler, cleaner operation. The only truly decorative floodlights designed specifically for any outdoor application.

Write for Award Series catalog: LP-A. See Sweet's Architectural file: 33a/ST.

STONCO Award Series

Cluster Lights • Power-Beams • Vaportight Mercury Vapor • Emergency Portables

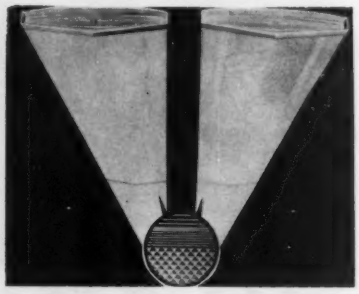
© 1960 Stonco Electric Products Co. Kenilworth, New Jersey

New products

Fluorescent diffuser

A new 3 in 1 diffusing element is featured in the latest addition to the commercial fluorescent lighting fixture line of the Benjamin Division of Thomas Industries Inc., 207 E. Broadway, Louisville, Ky.

The shallow "Coronado" units have an apparent depth of only 2½ inches, which makes the line particularly adaptable to offices, schools,



banks, and other interiors that require high quality illumination in an attractive ceiling mounted lighting unit.

The Coronado features a 3 in 1 lens which incorporates an L-120 prismatic diffusing lens on the bottom, a linear refracting lens on the sides directing light out of glare zone and a new refracting lens on top to eliminate ceiling "hot-spot." The units are designed for surface mounting and come in a new white Prisopal lens and the popular clear polystyrene lens.

Write P-1015 on reply card, pg. 17.

Commercial efficiency lamp

A new fluorescent lamp, one of the most efficient ever produced commercially, is now available from the Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.

The highly-efficient fluorescent lamp provides 15 per cent more light than standard 40-watt cool-white lamps, and 36 per cent more than daylight-type lamps, as the result of a new phosphor combination. It produces 3,200 lumens, compared to 2,800 for ordinary 40-watt fluorescent lamps, and it has excellent light-maintenance characteristics.

The new high-efficiency white fluorescent lamp was designed solely for maximum efficiency in order to provide industry with greater economy in their lighting costs. It is suitable for all uses where high light output at low cost is more important than critical color rendition.

Special green phosphors provide the unusual high efficiency in the lamp, balanced by color-improving phosphors, rich in red, to provide an eighth shade of white fluorescent light. The new color produces a cool comfortable atmosphere, ideal for seeing tasks.

Write P-1016 on reply card, pg. 17.

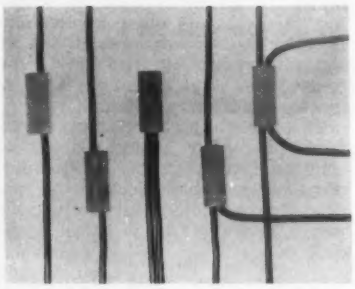
Wiremold wire connector

T-splices without twisting, soldering or taping, are simple with a new wire connector developed by The Wiremold Co., Hartford 10, Conn.

One of the only pressure-type connectors of its kind, the UL-listed device is for common connection of 2, 3, or 4 No. 14 AWG or No. 12 AWG solid conductors. No slack is needed, so any spliced installation is easy.

One of the features of the 1-5/16-inch x 1/2-inch connector is the ease with which it can be used. The wire is stripped to the width of the connector and inserted as far as it will go. The conductor cannot pull out or work loose. A strip gauge is molded into each device.

Originally designed for use with the company's Plugmold multi-outlet



system, the unit will handle any splice. It comes in cartons of 10 or 50 and is designated the W-30 wire connector.

Write P-1017 on reply card, pg. 17.

Eagle quiet a-c switch

The Touch-A-Matic, a silent switch that can be operated by simply pressing, tapping, flipping, or rolling the rocker-arm, is now being offered by the Eagle Electric Manufacturing Co., Inc., 23-10 Bridge Plaza South, Long Island City 1, N. Y.

Designed for 120/277-volts a-c service, the device has both screw and E-Z wire pressure terminals, as well as three common terminals for convenient feed-through connections. This UL-listed switch is small and compact, giving more ease in installation.

The switch's patented mechanical action is independent of hand move-

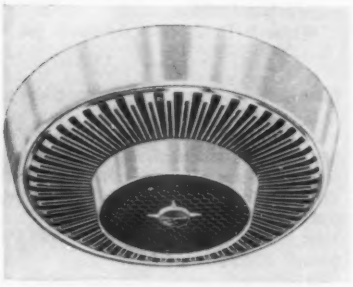
ments, supplying a "fast make" and "slow break" automatically, thus incorporating the proper principles in a-c switches with a minimum of manual operations.

Write P-1018 on reply card, pg. 17.

Contemporary bath heater

The new contemporary-designed Rangaire electric bathroom heater for ceiling mounting is being introduced by Roberts Manufacturing Co., P. O. Box 177, Cleburne, Texas.

Designed to harmonize completely with modern bathroom fixtures, the



new Rangaire heater features forced air instant heating, contemporary "sunray" styling and easy flush-mount installation.

Heaters are available in mirror-finish aluminum or gold anodized finish.

Write P-1019 on reply card, pg. 17.

Load break entrance switch

A compact new load break service entrance switch, Bolt-Loc, with ingenious safety and operating features, has been placed on the market by The Barkelew Electric Manufacturing Co., Middletown, Ohio.

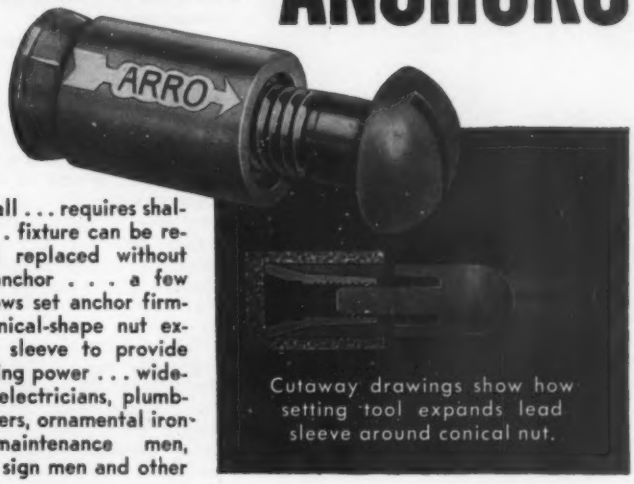
Bolt-Loc pressure contact switches combine maximum current-carrying and load-interrupting features with a modern, compact, rugged and easily mounted design.

They can be furnished in 1,200, 1,600, and 2,000 ampere capacities for 240, 480 or 600 volt a-c service. Two, three, and four-pole switches are available, fused or unfused, for front or rear connection.

With the advanced Bolt-Loc sys-

TRADE ARRO MARK

MACHINE SCREW ANCHORS



Cutaway drawings show how setting tool expands lead sleeve around conical nut.

Easy to install . . . requires shallow hole . . . fixture can be removed and replaced without loosening anchor . . . a few hammer blows set anchor firmly . . . conical-shape nut expands lead sleeve to provide strong holding power . . . widely used by electricians, plumbers, carpenters, ornamental iron-workers, maintenance men, awning and sign men and other tradesmen.

THE TRADE ARRO MARK LINE OF MASONRY ANCHORING AND DRILLING DEVICES

HAMMERLESS SETTING TOOL

Expander hammerless setting tool for easy installation of Arro Machine Screw Anchors in hollow tile, bottomless or weak-bottom holes.

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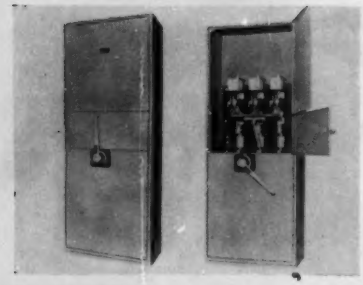


tem, the pressure mechanism firmly bolts the blades to the contacts when the handle is moved to the closed position. Arcing and pitting of the main contacts are prevented by auxiliary springs which maintain an initial pressure when blades are opened or closed.

When the handle lever is moved far enough, a quick-break mechanism opens the blades. The handle lever provides positive opening and closing.

Write P-1020 on reply card, pg. 17.

One-piece fluorescent shield

The Hi-Lo Wrap-Around, a new line of Metco fluorescent fixtures, has been announced by the Metalcraft Products Co., Inc., 6225 State Rd., Philadelphia 35, Pa. The new line features a one-piece plastic shielding that combines a high intensity, clear flat prismatic lens bottom with low brightness sides.

Only 3⅝ inches deep, the new fixtures have a modern two-color effect. Also, because the metal end plates can be removed, the fixtures can be installed in continuous runs, with no "blackout zones."

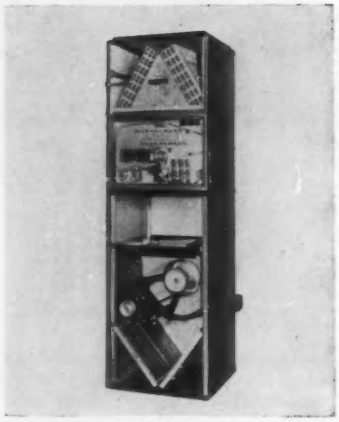
Write P-1021 on reply card, pg. 17.

Modulated electric furnace

The "Electro-Flo" Furnace, made by the Stewart-Warner Corp., Lebanon, Ind., is one of the most completely modulated electric furnaces available to home builders and home buyers today. It provides all of the advantages of air-distributed heat, including provision for summer cooling, either at time of original furnace installation or subsequently.

While most electric furnaces provide only up to four-stage heating, the Electro-Flo has the exclusive "Selective-Sequencer," a modulating device which controls up to nine stages of heating, depending on the capacity of the furnace. The Selective-Sequencer gradually actuates from three to nine motor-operated switches, one for each pair of heating elements of approximately 10,000 Btu output.

If at any time there should be a power failure or a high limit switch



interruption, a clutch built into the Sequencer releases and drops out all stages of heat. When the power is restored or temperature returns to a safe level, the Sequencer then starts automatically with the lowest heat stage, and builds up to the desired heat.

The heating elements add heat in steps of 10,000 Btu/hr. If the heat demand lies between the capacities of any two heating elements, the Sequencer will switch each on, as required, to maintain the optimum comfort condition.

Write P-1022 on reply card, pg. 17.

Non-interchangeable breakers

A new non-interchangeable feature now available on all circuit breakers, load centers, and panelboards of the Square D Co., Mercer Rd., Lexington, Ky., meets all requirements of Paragraph 240-25G of the 1959 National Electrical Code.

No modifications are necessary for 15 and 20 ampere breakers, which constitute 80 per cent of all branch circuits. Where higher rated breakers are required, authorized personnel can make quick, easy modifications to the interior rejection rails. Errors can be corrected easily without new parts, and all modifications can be made without removing interiors. There are no loose parts or screws to change or remove. The entire system is completely visible for ease of inspection.

Write P-1023 on reply card, pg. 17.

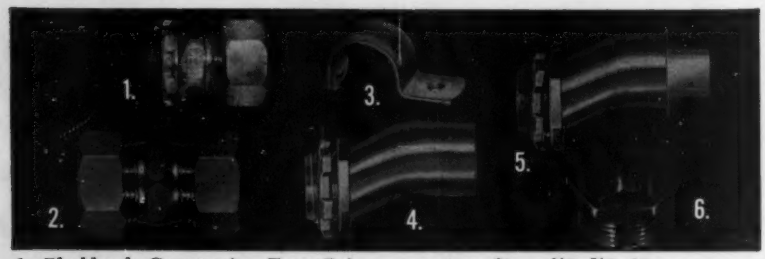
One-piece compression taps

The introduction of compression taps by The Thomas & Betts Co., Elizabeth 1, N. J., completes the company's line of Color-Keyed lugs, two-way connectors, pigtails, and installing tools.

This C Tap is a simple, one-piece construction designed to give low installed cost. Nine C Tap sizes will tap any two Code copper conductors from two No. 10's to two 1/0's and any combination of large main to smaller branch from No. 10 to 3/0. All around

QUALITY, ECONOMY, EASE OF INSTALLATION

— that's BLACKHAWK'S complete line of E.M.T. fittings



1. Blackhawk Compression Type Raintight E.M.T. Connector of heavy steel, cadmium and zinc finished to eliminate corrosion. Sizes: ½" to 2".

2. Compression Type Raintight E.M.T. Couplings. Blackhawk connectors and couplings feature full, true, perfect threads for ease and speed of installation. Sizes: ½" to 2".

3. Blackhawk famous Snap-Straps made to fit thinwall conduit. Snaps tighter, holds its grip. Sizes: ½" to 2".

4. Crimp type Blackhawk Offset — E.M.T. Connector. Scientifically formulated die cast alloy offset fittings are proved to be real labor-saving devices. Sizes: ½", ¾", 1".

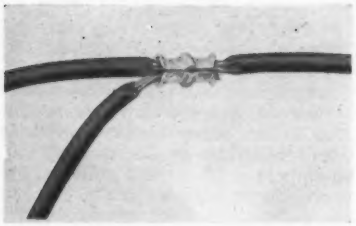
5. Raintight Blackhawk Offset — E.M.T. conectors. Sizes: ½", ¾", 1".

6. Blackhawk Machined Split Steel Adaptor. Will adapt any female threads to the same size E.M.T. No other special parts needed. Zinc plated. Sizes: ½" to 2".

Blackhawk's new E.M.T. fittings are a product of continuing Blackhawk research and automated methods of manufacture. Order a stock today from your electrical distributor to meet the demand for these quality made, E.M.T. fittings.

Blackhawk Industries DUBUQUE, IOWA

where the new ideas come from



compression of the C Tap assures a tensile strength exceeding Underwriters' Laboratories' requirements.

As with all Color-Keyed connectors, the color bands on the C Tap match corresponding colors on the dies of the installing tools assuring correct compression and permanent installation.

Write P-1024 on reply card, pg. 17.

Instant tape dispenser

Plymouth Rubber Co., Inc., of Canton, Mass., manufacturers of the Slipknot electrical tapes, has introduced a revolutionary new instant tape dispenser and case called the "Flip 'n' Cut." It is designed to hold the standard 66-foot roll of Slipknot No. 7 plastic electrical tape.

Test-marketed in the mid-west earlier this year, the "Flip 'n' Cut" won instant acclaim from electrical

distributors and electricians alike, the manufacturer reports. It is easy to use, handy to carry, and sturdy enough to withstand the rigors of the toolbox as well as the job. It is made of high-impact rigid plastic. Design patent is pending.

Write P-1025 on reply card, pg. 17.

Polypropylene plastic clamps

Holub Industries, Inc., 430 Elm St., Sycamore, Ill., is introducing a new line of "Loop Type" plastic clamps made of Polypropylene. These clamps are lower in cost than other types, because Polypropylene is so light in weight that more clamps can be produced per pound.

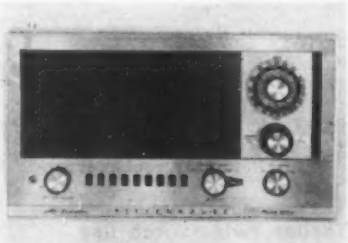
It is claimed that Polypropylene clamps are exceptionally tough. They have high tensile strength and great rigidity; excellent dielectric properties, even at high frequencies; also, resist solvents, grease, oil, many common acids and chemicals. They are recommended for general use, indoors or outdoors.

Clamps are available in seven popular sizes, and are molded to assure uniform size and shape. All edges are round and smooth to give full protection against vibration, strain and pulling.

Write P-1026 on reply card, pg. 17.

Rittenhouse sound system

A complete built-in, full-time transistorized home sound system with FM/AM transistorized radio,



plug-in mounting for faster installation, large speakers and powerful amplifiers for high fidelity reproduction of recorded music and new versatility that provides private room-to-room intercom service from any point in the home, is now being offered by The Rittenhouse Co., Inc., Honegye Falls, N. Y.

This sound system offers several unique advantages: Intercom Service —the system gives complete two-way room-to-room intercom, door-answering, and monitoring service from any room, and permits private calls directly from any remote station to other remote stations without broadcasting over the entire system. Built-In Radio—fully transistorized AM/-FM operation brings music to any room in the home. Recorded Music—a unique Rittenhouse arrangement of inexpensive remote input receptacles provide for present or future connection of living room hi-fi or stereo equipment.

Write P-1027 on reply card, pg. 17.

Hairpin stab for busway

An exclusive inverted hairpin design that actually exerts more than normal pressure when carrying heavy inrush or short circuit currents is the feature of a new stab now being introduced by Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J., for use with take-off devices in low-impedance plug-in busway.

The new stabs actually exert more than the normal 60 pounds pressure. Because of the stab's unique inverted

60 PAGES IN FULL COLOR

This new lighting fixture catalog instructs, intrigues and excites — even as it displays a product line of unmatched breadth of selection and ability to satisfy a particular need. Budget-priced favorites and superb decorator luminaires alike are found on these pages . . . as are dimming and photo-electric light controls; a complete range of pendants and pulldowns, posts and lanterns; fluorescent and recess lighting. Profusely and handsomely illustrated in full color . . . descriptions that are informative and action-provoking. This happy combination of merchandise, artistry and text adds up to a catalog that will be a delightful source of reference for all home decorators.

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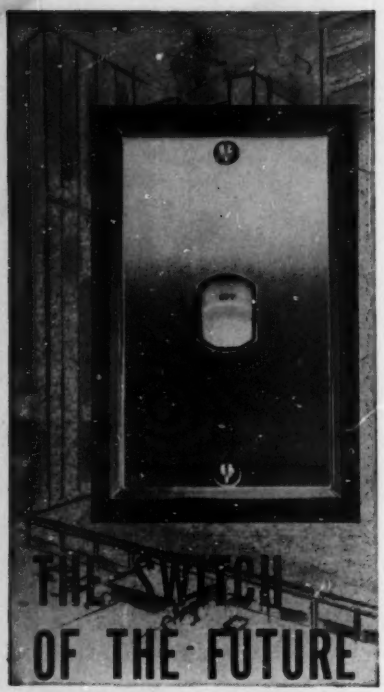

is being used NOW!...

P&S ROCKER-GLO SWITCH

Many of today's switches are specialties primarily designed for appeal in decoration. Others are designed to meet the rugged use and performance called for by a heavy duty switch.
Now, one new switch, Rocker-Glo, combines eye-appealing design with heavy duty performance. So impressed with this combination are architects, engineers and contractors that Rocker-Glo is already being specified in leading hotels, motels, hospitals, commercial buildings and housing developments. Rocker-Glo has high-grade silver alloy contacts. Its modern design and unique construction allow this switch to be pressed, pushed, rocked or rolled into instantaneous action.
Rocker-Glo switches are designed to be used at full current rating on tungsten filament and fluorescent loads. Available in Despard interchangeable type, Despard type mounted on a strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps. 120/277 volts AC.

P&S *Write for free Rocker-Glo bulletin — Dept. ES-106.*

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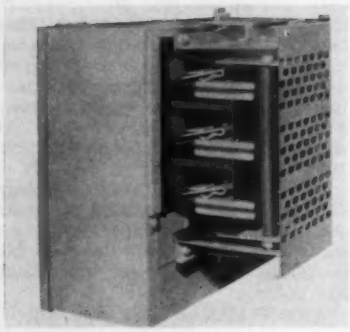
60 E. 42nd St., New York 17, N.Y. • 1440 N. Pulaski Rd., Chicago 51, Ill. • In Canada: Renfrew Electric Co., Ltd. Toronto, Ontario



hairpin design, short circuit current travels through the stabs in such a way that one contact prong is pressed harder against the bus bar at the same time the other prong is forced against a leaf spring that is coil spring loaded.

The special advantage of Federal Pacific's new stab is in heavy-duty industrial applications. Where resistance welders are used, the new stab design will take more than twice the 16,000 amperes inrush current sometimes encountered.

Write P-1028 on reply card, pg. 17.

Theiler twin switch line

H. J. Theiler Corp., Whitinsville, Mass., has recently introduced a new line of Feathertouch wall switches. The new twin switch line is designed for use where space is limited, and is ideal for installing extra lights without costly electrical alterations. This is one of the few switch designs which can be operated vertically with two switches in one convenience outlet box.

All Feathertouch switches are UL listed, specification grade, and have sturdy porcelain bases. All are easily and quickly installed in any position, without bending of wires. Their special features are operation at touch, and silent operation.

The new twin switch line is available in five combinations of switches or of switches and receptacles.

Write P-1029 on reply card, pg. 17.

200-ampere entrance switch

The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford, Conn., announces the availability of a new 200-ampere entrance switch. This switch comes factory-assembled with a main 200-ampere pullout, four 30-ampere or 60 ampere pullouts, and twelve fused branch circuits. One or two pullouts and two or four branch circuits can be added at any time.

This same "Add-On" feature makes it possible to meet a wide range of electrical needs with a very small inventory. All "Add-On" pullouts and branch circuits for this 200-ampere switch are interchangeable with similar units used in Arrow-Hart's 100-ampere entrance switches.

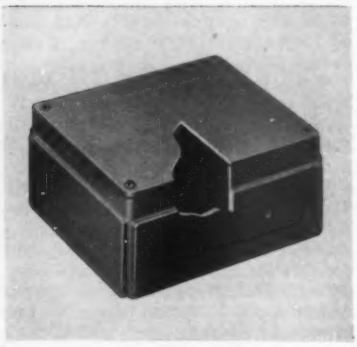
The new switch also features a hinged main pullout to provide ease of operation.

Write P-1030 on reply card, pg. 17.

Weather proof junction boxes

A line of weather proof cast aluminum junction boxes with four walls padded for the required 5 threads of conduit engagement are produced as standard by The Adalet Manufacturing Co., 14300 Loraine Ave., Cleveland 11, Ohio. The extra thickness of metal, cast as an integral part of the box walls, eliminates delay formerly encountered when special castings were required to add conduit opening bosses.

Offered by Adalet in its surface-mounted unflanged "JP" line, the padded boxes assure rainproof and dust-tight installation. The units may be stocked by distributors and users,



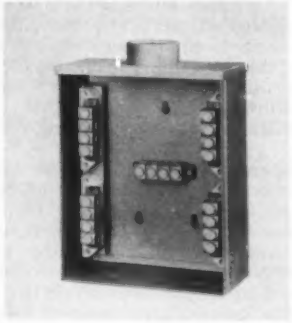
and site-drilled and tapped to accommodate any conduit layout situation. If desired, the boxes can be factory-drilled and tapped to layout. If additional holes are needed, they can be added in the field by the contractor without delay.

Write P-1031 on reply card, pg. 17.

200-ampere terminal boxes

Weatherproof terminal boxes for 200-ampere, 125/250-volt service are now offered by Hoffman Engineering Corp., 835 Tyler St., Anoka, Minn.

The galvanized steel boxes contain from three to five bus bars to provide neat, easy wiring connections for use in outdoor wiring. Models with three bus bars are used with single phase service and four bar models with 3-phase service. The five bus bar model is used for special applications such as split circuits and 2-phase, 4-wire service. In each model, one bar provides the grounded neutral and the



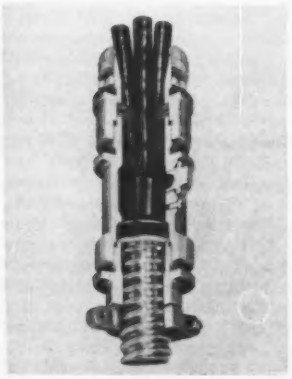
other bars are insulated by ceramic mountings.

Each bus bar has four pressure connectors accommodating either copper or aluminum wire up to No. 4/0 copper in size.

Write P-1032 on reply card, pg. 17.

G&W armor cable fittings

A new line of fittings for all interlocked armor cable now commercially available has been announced by G&W Electric Specialty Co., 3500 W. 127th St., Blue Island, Ill. The Series 800 Fittings not only terminate, but also support, ground, mount, and dead end the cable.



Series 800 Fittings are available in four basic pipe sizes covering the entire range of interlocked armor cable sizes now on the market. Eight different fittings are available in each size for various applications ranging from simple armor clamps to compound-filled terminations that can be used in any position.

High strength aluminum is used for all parts. Seals to cable and to junction box are positive and long-lived through the use of Resistoyl (synthetic-rubber) gaskets.

Write P-1033 on reply card, pg. 17.

New product briefs

Markstone Mfg. Co., 1531 N. Kingsbury St., Chicago 22, Ill., has just introduced a new 150-watt **recessed eyeball fixture** for public rooms or offices. It has had the bulk removed and is the smallest 150-watt eyeball fixture made. The frame of the unit fits into the contour of the ceiling. Streamlined design, coupled with "T-N-T" mounting, provide smart appearance and quick simple installation, the unit measures only six inches in diameter.

Write P-1034 on reply card, pg. 17.

The Alco-Lite P400 fiberglass **safety platform ladder** is one of a line of new Alco-Lite fiberglass industrial ladders now being manufactured by the **Aluminum Ladder Co.,** Dept. 517, W. Darlington St., Florence, S. C. The ladder is a non-conductor of electricity as well as being non-absorbent. It provides maximum safety around high voltages and resists the damaging effects of moisture, chemicals, acids, fumes, and gases. The ladder meets ASA Code A14.2 for portable metal ladders.

Write P-1035 on reply card, pg. 17.

A new hydraulic-magnetic **circuit breaker** that is little more than the size of a matchbox, and weighs only 1½ ounces has been announced by the **Heinemann** Electric Co., 240 Magnetic Dr., Trenton 2, N. J. The new Series VP breaker incorporates shock- and vibration-resistant features that make it suitable for use in airborne, portable, and mobile equipment. It is priced for commercial applications, requires only a single mounting hole, and can double as an "on-off" power switch.

Write P-1036 on reply card, pg. 17.

A new concept in **motor control design** through 30 hp, 550 volts, offers unitized construction with all components front removable. Made by **Furnas Electric Co.,** 1064 McKee St., Batavia, Ill., features include plug-in

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PORCELAIN
RECEPTACLES
No. 1736
No. 1924
OPEN-TOP WIRING — ready for immediate wiring — speedy and easy installation without removal of the interior mechanism. DUST-PROOF (Completely enclosed) INTERIORS with extra large binding head screws that are backed out and staked. Replaceable interior gives absolute satisfaction on full rated loads with performance that far exceeds Underwriters' Standards. Porcelain Receptacles No. 1736 and 1924 are pull-chain, three piece with shadeholder groove. For 3¼" or 4" box.
No. 1734 is our all-time favorite, with shadeholder groove. For 3¼" or 4" box. Complete with chain and cord.
No. 1634 Keyless receptacle with shadeholder groove. For 3¼" or 4" box.
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type push buttons or selector switches, easily added in the field. Thermal overload relays with trip indicator are trip-free and tamper proof. Third overload can be added in the field without changing enclosure. Magnet coils are molded type dual voltage (110/220 or 220/440) dual cycle (50-60). Coil has molded terminal board eliminating leads.

Write P-1037 on reply card, pg. 17.

A small-sized **transformer** that can provide a silent and dependable source of electrically isolated power has been developed by the **Sorgel Electric Co.**, 838 W. National Ave., Milwaukee 4, Wis. Especially suited for hospital operating room service, the Quiet-Quality transformer can supply all lighting, portable machine outlets, x-ray viewers, clocks, and similar power needs in its present form.

Write P-1038 on reply card, pg. 17.

Add-A-Phase, Division System Analyzer Corp., Nokomis, Ill., has announced a new multi-motor **power converter** designated type MM. Basically, the unit permits the operation of three-phase electrical equipment from single-phase lines, but with the additional feature of opening operation to any number of three-phase motors through a single conversion system. Three-phase motors can be operated singly or simultaneously. The multi-motor Add-A-Phase will produce 100% rated horsepower for all motors connected to the unit.

Write P-1039 on reply card, pg. 17.

A two part adjustment cast iron **floor box** now available from **Fullman Manufacturing Co.**, 1209 Jefferson St., Latrobe, Pa., allows concrete to be poured to the very top of the box in just one operation. After the concrete has set, the top adjusting section of the box is lifted out, providing easy access to wiring. The device is listed by Underwriters' Laboratories.

Write P-1040 on reply card, pg. 17.

Flat, rectangular **fluorescent lamps,** representing an entirely new concept in fluorescent lighting, have been recently introduced by the **Westinghouse** lamp division, MacArthur Ave., Bloomfield, N. J. Thin, rectangular glass plates, no more than an inch and a half thick, produce fluorescent light. The lamps consist of a labyrinth or maze of passages sealed in a thin glass block. The arc or electric discharge travels this winding path through the glass block to produce, in effect, a large area source of light.

Write P-1041 on reply card, pg. 17.

Leviton Manufacturing Co., Inc., 236 Greenpoint Ave., Brooklyn 22, N. Y., announces the new 5800 Series of 20-ampere **grounding devices** designed to meet the heavy duty requirements of modern equipment, appliances and portable tools. The line includes single and duplex receptacles, also available with round covers, and a U-ground cap. Special configurations of both receptacles and cap, in compliance with the 1959 Code revisions, limits use of electrical equipment to 125 volts and no more than 20 amperes. The 5800 series permits the higher rated electrical equipment now more widely used in many additional residential, commercial and industrial uses, to obtain their full current requirements, operate more efficiently and safely.

Write P-1042 on reply card, pg. 17.

A projector **spotlight** which casts a beam to an exact room location has been introduced by **Halo Lighting Products, Inc.,** 4201 W. Grand Ave., Chicago 51, Ill. The new "Projecto-Spot" picture spotlight and adjustable downlight is capable of casting rectangles, squares and other geometric shapes to specifically illuminate pictures, corners, tables, buffets or other desired objects and areas. Adjustments up to 40 degrees from the vertical may be achieved. The maximum beam diameter is 63 degrees with an aperture opening of 1½ inches.

Write P-1043 on reply card, pg. 17.

Progress Manufacturing Co., Castor Avenue and Tulip St., Philadelphia 34, Pa., announces the "Gay Blades", a new series of companion **lighting fixtures**—four in all: ceiling pull-down; wall pulldown; 1-light pendant; 3-light pendant—styled to appeal to modern home-makers. Design of "Gay Blades" is a cage formed by pleasingly-fluted metal blades, or fins, around glare-free plastic diffusers. Basic unit is 10 inches in diameter, 10⅛ inches high, 100 watt capacity.

Write P-1044 on reply card, pg. 17.

A new miniature (3 to 10 ampere) **circuit breaker,** designed specifically to protect small motors in portable power tools and appliances, attaches to end of cord within minutes and protects motor from burning out due to overload or overwork. Designed by **Modern Manufacturing Co., Inc.,** 680 Davisville Rd., Willow Grove, Pa., these motor protectors will automatically cut off power when machine is overloaded or overworked, and a reset button, instead of fuses, is used to reset the circuit breaker.

Write P-1045 on reply card, pg. 17.

Meier Electric Co., 3525 E. Washington St., Indianapolis 7, Ind., has introduced a line of newly improved tandem plug-in **baseboard heaters** which achieve significant simplification, economy, and space saving. The heaters feature Revere aluminum Tube-In-Strip, a solid piece of flat sheet or strip aluminum or copper with built-in passages that are inflated by pressure in tubes.

Write P-1046 on reply card, pg. 17.

Everywhere . . . people prefer White-Rodgers electric heat wall thermostats—universally famous for styling, easy installation and years of trouble-free performance.

*Sold under the brand names of more than 50 manufacturers.

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Helpful literature

available to our readers

A new 36-page catalog describing the company's complete line of industrial and commercial **steel shelving** is now available from Penco Division, **Alan Wood Steel Co.,** Oaks, Pa. This publication, Catalog 2400, contains full information on boltless T-line shelving, angle shelving, tool storage inserts, drawer case units, bin units, custom shelving arrangements and truck shelving. Also included is a section on Penco steel lockers, storage cabinets, and bookcase shelving.
Write B-1047 on reply card, pg. 17.

Four recent bulletins have been issued by **The Kirlin Co.,** Detroit, Mich. "Kirlin **Lighting for Homes,**" a new eight-page, four-color booklet, shows suitable built-in ceiling lighting for all rooms of modern homes, as well as porches; "Kirlin **Exits**" contains a complete listing of Kirlin's all-aluminum rust-resistant line; **"Church Lighting,"** a color brochure; and **"Hospital Lighting,"** a booklet showing suitable recessed fixtures, with installation details.
Write B-1048 on reply card, pg. 17.

Complete details of a new **Smithcraft Corporation** plan to lease modern fluorescent lighting equipment for new or old buildings is outlined in a new four-page brochure. Smithcraft's brochure contains most of the information necessary to plan for a complete lighting installation under the **Lease-Light Plan.**
Write B-1049 on reply card, pg. 17.

A new Swimming Pool Control Catalog, describing the use of time switches for automatic **time control of pool equipment,** has been prepared by the **International Register Co.,** Chicago, manufacturer of Intermatic Time Controls.

This 4-page catalog describes in full, how time switches can be used for automatic control of filtration, underwater lighting, water heating, floodlighting, hypochlorination and pool alarms.
Write B-1050 on reply card, pg. 17.

A new, management-oriented publication that discusses the technology, equipment, and economics of **automation** is now available from **General Electric Co.,** Schenectady 5, N. Y. Titled "Automation and You," the 16-page bulletin (GED-3908) assesses the current state of the automation art, summarizes the need for and economic benefits of automation, and provides information for management on six key functions of automation: process control, computing, instrumentation, numerical control of machines, sensing, and communications.
Write B-1051 on reply card, pg. 17.

"Condulets for Corrosive Locations" is the title of a 20-page bulletin, just reissued with additional information by **Crouse-Hinds Co.,** Wolf and Seventh Sts., Syracuse 1, N. Y.
Write B-1052 on reply card, pg. 17.

A new bulletin describing a complete line of engine-driven **electrical generating systems** in the range of 10 to 200 kw is available from **Consolidated Diesel Electric Corp.,** 880 Canal St., Stanford, Conn. Included in the catalog is the firm's uninterrupted power supply for critical applications where even a few seconds' interruption in electrical power cannot be tolerated. Other products featured are adverse environmental power units and an automatic positive power system.
Write B-1053 on reply card, pg. 17.

A bulletin featuring the high voltage vertical-break Type "MK-40" **air switch** has been issued by Delta-Star Electric Division of **H. K. Porter Co.,** Chicago. The two-color, four-page brochure clearly describes and illustrates this linkless, leverless, and braidless power switch. A large photograph with keyed numbers points out the fully controlled blade mechanism, high pressure contacts, silver inlay contact points, hard drawn copper blade, factory sealed blade bearings, and the rotating insulator bearing.
Write B-1054 on reply card, pg. 17.

Bulletin 1425, an 8-page two-color bulletin on its revolutionary new **rotary handle circuit breakers** and their use in switchboards, control centers, panelboards, and enclosed circuit breakers, has been published by **Federal Pacific Electric Co.,** Newark 1, N. J. Covering the complete line of rotary handle circuit breakers from 15 amperes through 800 amperes, including EF, F, J, and M-frame breakers, the bulletin describes fully the features of the rotary handle mechanism.
Write B-1055 on reply card, pg. 17.

Detailed information on the high performance Thymotrol **speed variator,** which uses Thyratron tubes to convert a-c to d-c power, is contained in a new bulletin, GEA-7019, published by **General Electric Co.,** 1 River Road, Schenectady 5, N. Y.

The eight-page booklet describes the adaptability of the high performance Thymotrol drive to machine feed and spindle applications, reeling equipment, conveyor systems, processing equipment, textile machines, and any other application where precise speed control is essential.
Write B-1056 on reply card, pg. 17.

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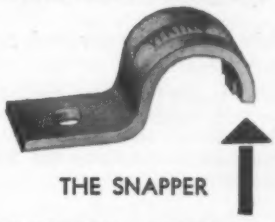

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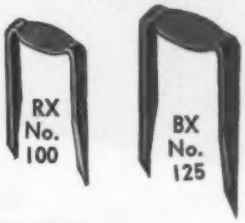

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Sun Oil Co., Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa., offers a new 6-page bulletin giving complete technical information on electrical **insulating oils** for transformers and cables. The bulletin discusses the functions of a transformer oil; gassing characteristics of oils; properties of electrical oils; uses for inhibited and uninhibited oils; and typical properties of each type. Information on cable oils includes a discussion of the oil requirements of the three basic types of cables; viscosity-temperature relationships of cable oils; resistance to gas evolution; oxidation stability.

Write B-1057 on reply card, pg. 17.

Bulletin GEA-7021, a 12-page publication by **General Electric Co.**, 1 River Rd., Schenectady 5, N. Y., discusses the complete line of the company's **relays** for all applications. Relays included are general purpose, machine tool, mechanically held (latched-in), pneumatic time-delay and synchronous motor-driven timing.

Write B-1058 on reply card, pg. 17.

Forty magic ways to beautify a home with light are shown in "The Light Side of Decorating," a new booklet just published by **The Superior Electric Co.**, makers of Luxtrol light controls. Included are at least four **lighting schemes** for every typical room and all were designed by C. Eugene Stephenson, F.A.I.D. internationally known designer and authority on home lighting. The 36-page booklet contains forty full color illustrations.

Write B-1059 on reply card, pg. 17.

A new manual containing many pages of data on procedures and equipment for measurement of **insulation leakage** at high voltage and voltage breakdown tests has been announced by **Associated Research, Inc.**, Chicago 18, Ill. Description is included of procedures for forecasting life of motor and generator insulation, testing breakdown of cable installation and re-built motors and generators.

Write B-1060 on reply card, pg. 17.

NL Corporation (formerly Novelty Lighting) of Cleveland, Ohio, announces the publication of their new Church Lighting Catalog No. 74. This catalog is a basic reference for anyone interested in selecting appropriate contemporary or traditional **church lighting** for new construction or relighting installations. NL's new catalog groups the lighting fixtures by related architectural styles for easy selection.

Write B-1061 on reply card, pg. 17.

The Moe Light division of **Thomas Industries Inc.**, Louisville, Ky., leading manufacturer of residential, commercial and industrial lighting fixtures, introduces its 1960 **recessed lighting fixtures** with a 36-page, color catalog covering a completely new line of residential and commercial units. The new catalog offers installation instructions, light curves and coefficient tables, as well as detailed drawings of all recessed units, including square, rectangular, opal glass, round, adjustable beam, shower and aisle light types.

Write B-1062 on reply card, pg. 17.

With rigid polyvinyl chloride **electrical conduit** gaining increasing popularity in the electrical field, **Kraloy Plastic Pipe Co., Inc.** offers a new, complete 20-page catalog. Included are comprehensive test results, specification information, installation instruction, corrosion resistant charts, and other valuable data.

Write B-1063 on reply card, pg. 17.

A new 12-page booklet, "Useful Tips For Top Savings And Service," has just been issued by the **Dutch Brand (Electrical Tape) division of Johns-Manville.** It covers 24 **specific tape jobs,** from protecting electricians' tools to use of color-coded tapes to speed mass assembly of electrical components and products. The booklet is easy-to-read, clearly illustrated, and there is valuable product information to help in the selection of the most practical, economical tape for any given job.

Write B-1064 on reply card, pg. 17.

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(October 1960)

Tractor-trailers

(Continued from page 57)

town a good distance away. I have a big billboard type sign on the trailers. This establishes the fact that you're a pretty good size operator.

It used to cost me $25 to move a trailer onto a job and $25 to move it off, but I eliminated this by buying the tractor. The trailers stay on the job until it's finished, then the surplus is loaded up and returned.

In February, I used three of the trailers on the West Texas State College campus, 20 miles south of Amarillo, where I had the work on two dorms and a student center.

Back in 1948 I conceived the idea of going into the wholesale business. I bought a tractor-van, binned it, filled it with material and put a salesman on the road; but the overhead was too high and this didn't pan out. Then I decided the van would make an ideal on-the-job warehouse.

How many trailers or how big depends of the contractor's situation. My trailers include two 28-footers, a 20, a 24, and a 33-foot size. I was the first contractor to use them in this area, but some others have become interested since. Use of trailers is about the most profitable idea I've had in the 21 years I've been in business in Amarillo.

Economic comment

(Continued from page 6)

softness and decline, a reduction in the price of the "blue chip" may be anticipated, though usually not to the extent of other more speculative issues.

Advice to the investor is always a dangerous item to offer. But there is one principle that should guide every purchaser of securities, whether they be mutual funds, corporate shares, or other types of investment. A well-established and planned program with ultimate goals and objectives clearly indicated will provide the investor with relative freedom from worry from all but the most drastic movements in security prices.

Code

(Continued from page 113)

quired by Section 430-89 for separately excited d-c motors, for series motors, and for converters and MG sets which by a decrease in load or by current reversal can be driven at excessive speeds from the d-c end unless the mechanical part of the equipment is designed to limit the speed or unless the machine is manually controlled by a qualified operator. By qualified operator is meant an operator who is constantly attending the controls, such as a crane operator, not a maintenance engineer who is merely on the premises.

Section 430-90 requires fused switches, when such switches are used as controllers, to be capable of accommodating the size fuses listed in Table 430-146 for motor-running overcurrent protection unless time-lag fuses designed for motor starting are used, in which case smaller size switches are permitted. Such switches are required to be capable of safely starting and stopping the load in any case whichever type and size switch is selected.

In the next issue, motor disconnecting means and other motor requirements will be discussed.

Answers to Code test questions: (1. **T** Section 430-81-b) (2. **T** Section 430-81-c) (3. **F** Section 430-82-b) (4. **T** Section 430-82-c-1) (5. **F** Section 430-82-c-1) (6. **c** Section 430-72) (7. **b** Section 430-82-c-2) (8. **b** Section 430-88) (9. **a** Section 430-89-b) (10. **c** Section 430-83).

Knoxville promenade

(Continued from page 51)

there are two 100-watt fluorescent, tubular cool-white, rapid-start tubes.

When a trench had to be built, easement rights were obtained from the parking lot operator, who had a long lease. KUB and the electrical contractor both worked together on the trench.

The parking lot operator installed five poles with 400-watt mercury lamps for illuminating the lot next to the promenade.

Underground apparatus

(Continued from page 87)

lowered into place over the connected transformer. Accessible mounting bolts then can be used to secure the transformer to the housing, and to fasten the housing to the mounting pad.

Over-all plan dimensions would be 32 inches by 44 inches, with a height of 46 inches through 25 kva, and a height of 53 inches above 25 kva.

For the simple radial or "utilization transformer" system, only the housing and a suitable pole-mounted distribution transformer would be needed. Housing surface temperatures would be considerably lessened, safety hazards reduced, and change-out problems greatly simplified when compared to the "utilization transformer" installation.

For the looped lateral system utilizing a single disconnect, this transformer housing has provision for mounting a Westinghouse Type "CSO," single-pole, oil switch within the H.V. compartment. This switch, shown in position in Figure 6, has a full load-break rating of 200 amperes at system voltages up to 14,400 volts, thereby eliminating the need for additional load-break devices at the H.V. feeder tie. This switch is completely self-contained so that it is

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easy to install or remove as the character of the application changes. It is practically maintenance-free, performing up to 10,000 switching operations before inspection is required. For this application, a knife-blade attachment is available for the oil switch, to give visual indication of an open disconnect.

For the looped lateral requiring two separate disconnect points at the transformer location, provision is made within the H.V. side of the housing to mount a two-position S. & C. blade disconnect with "Loadbuster" attachments. The center position of this multiple disconnect can be supplied with an H.V. fuse, readily accessible through the door of the H.V. compartment.

It is apparent that the success of the several methods of underground residential power distribution depends to a great extent upon the cost of the specialized equipment necessary for their installation and use. Of this equipment, the most costly items are the distribution transformer and the transformer enclosure. The present state of development of underground distribution systems indicates that it is much too early for transformer manufacturers to standardize on any one distinct type of transformer or transformer enclosure for this application.

It is now thought that a standardized, mass-produced housing, using standard pole-type distribution transformers and having provision for the addition of switchgear and protective devices to suit all proposed systems, will find acceptance by many electric utility companies.

Substation grounding

(Continued from page 92)

capable of producing ground currents should be made. Present system conditions, as well as probable future extensions, should be included in such a study.

Considering such matters as soil resistivity, number and length of electrodes, soil conditions vary so widely that it is difficult to predict how many rods will be required to give a certain resistance or how deep the rods must be driven to reach the better conducting soils. Each installation must be studied individually and a few preliminary tests at the substation site will usually provide the simplest and quickest way of obtaining information that will be helpful in the design of the grounding system.

If the soil were of a homogeneous nature throughout and had the same resistivity at all depths, it would be possible to predict, with reasonable accuracy, the length of the rod that would have to be driven to give a desired resistance. This can be seen from the chart, Figure 4, which shows theoretical curves of resistance for various lengths of rods, assuming homogeneous soil with three different values of resistivity. For example, in soil having a resistivity of 10,000 ohms per cubic centimeter, a 10-foot rod would have a resistance of 30 ohms while in soil of 1000 ohms per cubic centimeter it would have a resistance of only three ohms.

This chart shows that, theoretically, lower resistances can be obtained by the use of longer rods driven deep into the earth. This has also been found to be the case in actual practice, although because of the non-uniform nature of the soil, the resistance-depth curves seldom show a straight line relationship. Also, underlying rock

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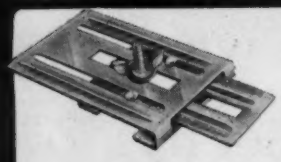

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strata may sometimes prevent the driving of long electrodes. However, nearly always, where long rods can be driven, the practical improvement is greater than the theoretical because the deeper soils tend to have lower resistivity than the surface soils.

Flicker control

(Continued from page 96)

ficiently high to develop the required motor torque. Some electronic devices experience difficulties in operation resulting from voltage variations.

Several graphs are presented here to facilitate the calculation of voltage dip due to motor starting on a 12.5 kv system. The graphs are drawn for NEMA code F motors but are readily adaptable to other codes. Figures 1 and 2 are plotted from reasonable approximations. In many instances, they have given results quite close to those of a more detailed calculation. These charts are used only to obtain a quick estimate. A more detailed calculation is made if it appears to be necessary.

Figure 1 gives the per cent dip at the transformer bank secondary due to starting a three-phase NEMA code F motor. The dip is a function of the three-phase capacity of the transformer bank, per cent impedance, the short circuit capacity at the primary side (12.5 kv) of the bank, and the motor horsepower. As an example a 300-hp code F motor started on a 3000-kva bank of 4% impedance, with 2000 ampere short circuit capacity on the 12.5 kv primary side gives a dip of 5.8%. Figure 2 gives the per cent dip at the primary side of the transformer bank.

Figure 3 assists in the calculation of voltage dips for other code letters and for autotransformer starting. The following examples demonstrate the use of the charts. (1) A 500-hp code B motor is to be started at full voltage. From Figure 3, starting kva is 1750. This is equivalent to that of a 310-hp code F. Using Figure 1 for a 310-hp code F gives the same dip as for a 500-hp code B.

(2) A 1500-hp code F motor is to be started on an autotransformer at the 80% tap. This would be equivalent to starting a 960-hp ($.8^2$ x 1500) code F motor at full voltage.

(3) A 2000-hp code D motor is to be started with autotransformer tap at 65%. From Figure 3, starting kva at full voltage would be 9000 kva (use 200 hp and multiply by .10). With 65% tap, the starting kva would be 3800 ($.65^2$ x 9000). Using Figure 3 again, this is equivalent to starting a 690-hp code F motor at full voltage.

In conclusion, it appears that only the discretion and experience of the utility engineer can establish a permissible amount of flicker in a power system serving a combination of lighting and motor loads. In doing so, engineers must weigh the results of flicker and design distribution systems that will absorb fluctuations so that if the flicker problem arises, it can be solved without economic limits.

Office building

(Continued from page 44)

is an excellent example of cleverly matching new with old, maintaining the style, good taste, and solidarity of the original building exterior design while incorporating in the interior all the conveniences and facilities possible with good modern architectural and engineering design techniques.

Garden lighting

(Continued from page 47)

Fahsbender suggests outdoor-type extension cords which plug in on existing house circuits or in the garage. This calls for certain precautions: (1) Avoid overloading any one household circuit which, on the average, carries only about 1700 watts; (2) Protect extension cords, wherever they leave house or garage, against damage from closing doors and windows; (3) Tape all plug connections outdoors to keep moisture out and, in addition, drape them over a wood spike to keep above puddle level.

A permanently installed outdoor lighting system consists of underground cable buried in a trench and the use of waterproof convenience outlets above the ground level located to suit the home owner.

Cable-laying must conform, of course, to local regulations and requirements, and in order to meet these specifications, Miss Fahsbender stresses that home owners should turn over all wiring and rewiring jobs to a dependable electrical contractor.

The permanent outdoor lighting system is a convenience the year around. Weatherproof outlets come in handy for the use of hedge clippers, lawn mowers and other electrical garden equipment, or for

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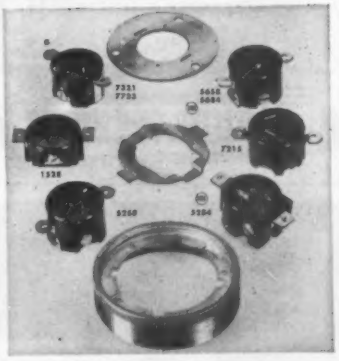

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a radio or TV set. They can be utilized also for outdoor Christmas lighting and for permanent yard-lighting.

Safety firsts

In the interest of safety, Miss Fahsbender underscores the following recommendations: 1: weatherproof cords and moisture-proof connections are a "must" for both temporary and permanent installations. 2. Turn off the electricity before replacing a light bulb. 3. Work in a dry garden. Any kind of moisture, even dew, must be guarded against.

Modern home lighting

(Continued from page 41)

The kitchen has structural lighting, arranged under a cornice built around wall, under cabinets, and extending over the range. A central ceiling fixture provides general illumination. This fixture is a two-tube, well-diffused fluorescent unit.

The light in the utility room is a centrally located ceiling fixture, equipped with a white diffuser.

The house is supplied with all-year air conditioning by a heat pump. The all-electric kitchen is equipped with built-in oven, range, roll-out dishwasher, garbage disposer, and a 40-gallon electric water heater.

This first Total Electric Gold Medallion Home was sold after the first week of exhibition, but was kept open for inspection each weekend for four weeks. At night, with all lights turned on, it presented a splendid sight, demonstrating the beauty and utility of modern lighting.

Lighting training

(Continued from page 45)

L. Linebarger, former commercial sales representative with ten years experience, was named director of residential lighting promotion. Assisting Linebarger is Franklin W. Griffin, former customer service representative with six years utility sales experience. Both are headquartered in the company's General Office Sales & Development Department, in Little Rock.

To prepare for their new lighting assignments, Linebarger and Griffin attended an intensive instructors course of the "Academy of Lighting Arts," in Cleveland, Ohio.

In the initial stage of the program, the lighting personnel concentrated their work around a specially designed "Academy of Lighting Arts" program, which contains such teaching items as slide projectors, films, display and demonstration equipment, plus additional instructional material.

Director Linebarger explains, "The primary function of the academy is that of training certified lighting consultants. To accomplish this, our presentations concentrate on two major areas—education and sales promotion. Trainees are the lighting sales people of retailers, builders, contractors, distributors, architects, interior decorators, teachers, feature writers, company personnel, and other interested groups."

Academy schedule

Each academy course met once each week for twelve weeks. In the first schedule, Linebarger and Griffin traveled to four major Arkansas cities—Little Rock, El Dorado, Hot Springs, and Pine Bluff—with the academy training aids, visiting one city each night. Meetings were scheduled from 7 p.m. until 9 p.m. After 12 weeks, four more towns were scheduled and so on until all towns are reached.

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This will take about 18 months to cover the properties of the company. Total enrollment for the first four classes was 111 trainees. During the day, when time permits, Linebarger and Griffin visit dealers and sales allies' employees in the lighting industry.

Griffin, lighting sales coordinator, reports, "Attendance has been far beyond initial expectations. We are maintaining a 93 per cent attendance figure, even though some trainees have to drive 50 to 60 miles over mountainous roads to attend."

Linebarger and Griffin attribute the high attendance to three key factors: (1) Desire to know more about residential lighting. (2) A $25 tuition per student, rather than having a free, "come-when-you-can" arrangement. (3) Strict requirements which must be met in order to graduate as a Residential Lighting Consultant.

Cooperation from sales allies

Linebarger reports that early results have demonstrated "that it's a working program rather than a talking program.

"We find," Linebarger says, "that dealers are stocking better quality fixtures, better portable equipment, and are using structural lighting more effectively than before. This is one of the basic needs of our lighting program."

Linebarger and Griffin feel that the best indications of the academy's acceptance and success are the many requests for reservations made for the next academy sessions. There will be only three meetings per week, instead of four, since the instructors will be re-

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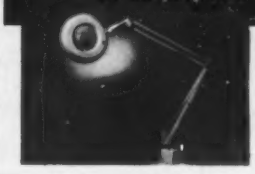

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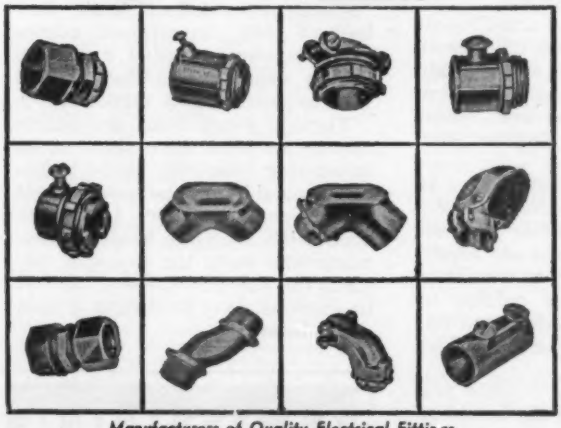

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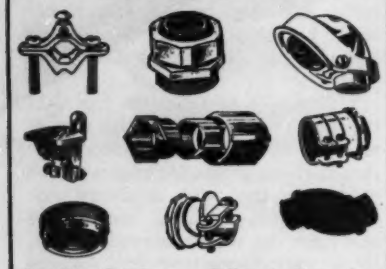

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visiting former trainees, keeping lighting information current, and lending assistance on special problems.

Arkansas Power & Light Company has employed five new home lighting consultants at three of its division offices. These five ladies are under the direct supervision of the company's division sales managers, although they look to Linebarger and Griffin for technical assistance.

These ladies underwent a special two-weeks training course under the direction of Linebarger and Griffin, utilizing the "Academy of Lighting Arts." They were hired specifically for their aptitude in the sales and public contact work.

Bank lighting

(Continued from page 39)

power. This system can be used during a main power failure to run one elevator and essential lighting.

From the studies made by the designers, the use of ordinary air diffusers that discharge air across the ceiling at a high velocity didn't seem feasible, since future partition movement might eventually result in "bouncing" the air off the adjacent partition, thus causing drafts. It was then decided that each four-foot module should have its own lighting unit plus a means of discharging air as required. Lumi-Flo troffers met these design specifications.

The key to the Lumi-Flo air handling system is the low velocity introduction of air straight down like gentle rainfall, thus eliminating "hot and cold spots" and the "bounce" of air from nearby partitions.

When the unit is acting as an air supply, a balancing valve is inserted with a flexible air hose connected to the metal air supply duct. Air requirements thus may be altered easily and quickly by bringing cool air to additional fixtures if office machinery or extra personnel are added.

Installation of the troffers proceeded smoothly and the combination units proved very satisfactory in effectively integrating the requirements of both electrical and mechanical devices.

The units are connected to the air duct system by a flexible tube with a snap-in collar that is supplied by the sheet metal contractor. The electrician installs the troffers, makes electrical connections, installs reflectors, fluorescent lamps, and the shielding element. The sheet metal worker installs the air valve and tubing and connects the tubing to the air ducts.

The air conditioning system is designed to move 120,000 cubic feet of air per minute and supply chilled and warm water to 33,000 square feet of ceiling panels for the supplementary system of radiant heating and cooling. The capacity of the refrigeration system is 400 tons.

Comfort will be provided throughout the seasons for the tenant floors and the banking spaces through the combination of air circulation and radiant heating and cooling. Design conditions are 78 degrees dry bulb and approximately 45 per cent relative humidity in summer, and 72 degrees dry bulb with approximately 40 per cent relative humidity in winter.

J. M. Clayton was the electrical contractor and Newcomb and Boyd the mechanical and electrical engineers. Daniel Construction Co., of Alabama, was the general contractor.

Washington report

(Continued from page 8)

July was $5.2 billion, a normal three per cent higher than that for June, the Census Bureau reports. Actual physical volume of construction in July was 6 per cent below that for July 1959.

Construction fell off in the first half of 1960. Government economists, however, predict a pick-up in the second half. They expect 1960 expenditures to match 1959's.

Though government economists foresee no persuasive signs of an impending recession, many economists outside of the government do. Economists for industries, economists for large banks, economists who write the financial columns in the newspapers, almost unanimously are predicting a slide in business.

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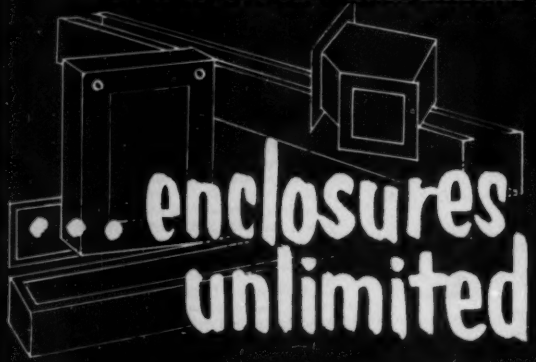

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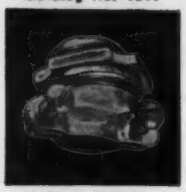
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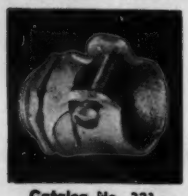
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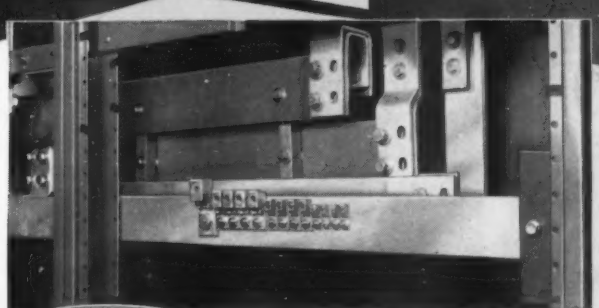

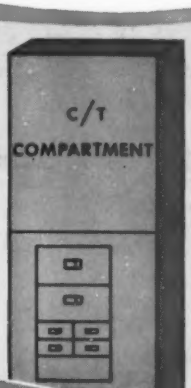

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— Fires starting in ceiling or wall near fixture.

— All lights on the line cutting off, throwing entire production lines or departments into darkness.

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